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# ECOLOGICAL ASSESSMENT OF VANDENBERG AIR FORCE BASE, CALIFORNIA

## VOLUME III. ENVIRONMENTAL PLANNING SYSTEM

CENTER FOR REGIONAL ENVIRONMENTAL STUDIES
SAN DIEGO STATE UNIVERSITY
SAN DIEGO, CALIFORNIA 92182

SEPTEMBER 1976

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(AIR FORCE SYSTEMS COMMAND)
TYNDALL AIR FORCE BASE
FLORIDA 32403

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This third volume of a three volume report contains a description and documentation of the computer-based Environmental Planning System (EPS) developed for Vandenberg Air Force Base (VAFB), California. The environmental inventory of VAFB provided the basic data, in computer-compatible form, for the EPS presented in this volume. The GRID computer graphics program and other computer programs used in the EPS are described. A detailed users manual is presented which describes the specific procedures for operating the computer → next page

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cont

programs with the computerized data base developed for VAFB. A complete description of the quantitative ecological data base upon which the EPS operates is provided. A series of case studies show how to apply the EPS to VAFB. An evaluation of manual and automated methods for determining areas of vegetation is presented using statistical tests to compare the various methods. Complete documentation is given for all computer programs used in the EPS.

## PREFACE

This final report was prepared by the Center for Regional Environmental Studies, San Diego State University, San Diego, California, under AFSWC Contract No. F29601-75-C-0116, and was funded by the Air Force Civil Engineering Center (AFCEC), Tyndall AFB, Florida. This work was accomplished under JON 21033E24. Major Rutherford C. Wooten, Jr., (AFCEC/EVP), was the Center Project Officer in Charge. This project was transferred from the Air Force Weapons Laboratory (AFWL), Kirtland AFB, New Mexico.

This report consists of three volumes: Volume I - Evaluation and Recommendations, Volume II - Biological Inventory 1974/1975, Volume III - Environmental Planning System. Volume III was presented as a master's thesis to San Diego State University in partial fulfillment of the requirements for the degree, Master of Science in Biology, by Richard M. Reilly.

This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

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Appreciation is expressed to Mr. Gary J. Zupan for providing computer programming assistance at San Diego State University, and Mr. Mike Hughes for implementing the computer programs in the Environmental Planning System (EPS) on the computer system at Vandenberg AFB. Special gratitude goes to Mr. Thomas A. Oberbauer for his assistance in interpreting and constructing the vegetation data base used in the EPS. We also thank Mr. Clark R. Mahrdt for his assistance in applying the EPS to map animal distributions.

The following source was used as a key reference in writing sections of this Users Manual pertaining to GRID:

Sinton, D. and Steinitz, D., GRID Manual, Version 3, Laboratory for Computer Graphics and Spatial Analysis, Harvard University, Cambridge, MASS, 1971.

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## SECTION I

## INTRODUCTION

This report contains a description and documentation of the computer-based ecological evaluation tools developed for Vandenberg Air Force Base (VAFB). It is presented as a companion to Volume I (Evaluation and Recommendations) and Volume II (Biological Inventory), (References 1,2). This volume is primarily intended for use by personnel involved in environmental planning.

The ecological inventory developed for VAFB provided the basic data, in computer-compatible form, for the Environmental Planning System (EPS) presented in this volume. The EPS is designed to be a flexible tool usable by base personnel having a minimum of computer experience. The EPS will calculate and display the area of each major vegetation type, or other ecologically sensitive unit, that is likely to be altered by any proposed development configuration. It will assist in the identification of optimal locations for development or operational actions, either for the Space Transportation System (STS) or other elements of the VAFB mission, on the basis of their relative ecological suitability.

This report is functionally organized in the interests of the user. Sections II and III briefly describe the EPS and how to use it. Section IV is a series of actual case studies using the EPS. Section V is a comparison of methods for determining areas of vegetation. The data presented in this section provide a comparison of the accuracy of the manual method versus the automated method for determining areas of vegetation. Section VI is a detailed Users Manual which describes how to use the computer programs in the EPS. Section VII is a description of the computerized data base in the EPS along with instructions for its use and updating procedures. The appendix contains complete program listings for the computer programs, subroutines used in the case studies, and the portion of the data base containing the irregular outline used by the GRID computer program to map VAFB.

## SECTION II

## DESCRIPTION OF THE ENVIRONMENTAL PLANNING SYSTEM

The EPS used for VAFB was based upon a study done for the coastal plain of San Diego County (Reference 3). Use of this type EPS seemed to allow for the concurrent experimental and observational design of the ecological assessment of VAFB.

The GRID computer mapping program was selected to display the computerized data base developed from the ecological inventory. The GRID program was developed at the Harvard Laboratory for Computer Graphics and Spatial Analysis. It provides a highly efficient means for graphic display of large quantities of information collected on the basis of a rectangular coordinate grid. The GRID program is written in FORTRAN IV. It is operational on the IBM 360 computer at San Diego State University and the Burroughs 3500 computer at VAFB.

The GRID computer mapping program is an automated alternative to drawing and planimetering overlays for mapping studies. The GRID program produces a composite map output which selectively displays from two to ten classes of data. GRID calculates the frequency of each class of data (the number of grid cells), the percent total by classes, and displays the results with a histogram. GRID has two distinct advantages over manual methods:

1. Combinations of overlays for displaying alternatives can be produced almost without limit.

2. The cost is minimal once the data base and the computer graphics program are established.

To apply the GRID program to VAFB, the area encompassing the base was divided into rectangular grids. Two grid scales of analysis were used. A square grid cell 1000 feet on a side was adopted for standard processing by the GRID program. This cell size was chosen because it was the same as the 1000-foot grid of the California Coordinate System used in the Base Master Plan maps (Reference 4). This provided a raster of 4646 cells (22.96 acres per cell) covering the entire base. For data requiring more detailed resolution, such as vegetation cover, the basic grid cell was subdivided into nine square subunits of 2.55 acres each. An interpretive subroutine in the GRID program then provides a decision for the assignment of each 23-acre cell to a category determined by the values of the nine subunits.

The EPS also contains a Search/Count program. This program is run independently of GRID with the computerized data base. It will locate and print out data base variables for selected grid cells. By entering the alphanumeric coordinates of selected grid cells, the program will print out the data base variables for each grid cell and count the frequency of each subvariable. The Search/Count program can be used, for example, to compute the areas of various vegetation types that would be affected by alternate placements of a runway-launch complex.

The computerized data base developed during the Vandenberg study contains both abiotic and biotic information coded into the grid system. For each grid cell the data base now contains an interpretation for soil type, slope, exposure, elevation, and vegetative cover. The data base exists on cards and magnetic tape. It is organized so that it can be easily updated.

## SECTION III

## HOW TO USE THE ENVIRONMENTAL PLANNING SYSTEM

To effectively operate the EPS, as a flexible tool for environmental analysis and planning, the user must be familiar with the components of the system and how they operate. Section II gave an overview of the EPS. A detailed Users Manual for operating GRID and the Search/Count program, as adapted for VAFB, is presented in Section VI. Many examples for use of different program options were incorporated into the Users Manual to aid in understanding. A complete description of the computerized data base developed for VAFB, and instructions for using it, are given in Section VII. The combination of the Users Manual and the data base description and instructions will provide the user with the tools to operate the system.

A series of case studies using the EPS are presented in Section IV. Several of the case studies are fully documented in the appendix with program listings. In addition, the appendix contains a complete program listing for GRID and the Search/Count program as adapted to the Burroughs 3500 computer. To gain initial experience operating the EPS, the user should practice by duplicating the computer output of one or a number of the case studies.

The user now has the tools, the data base, and the instructions for a computerized environmental planning system. The challenge is now to implement the EPS for operational environmental analysis and planning.

## SECTION IV

## CASE STUDIES - APPLICATION OF THE ENVIRONMENTAL PLANNING SYSTEM TO VANDENBERG AIR FORCE BASE

The following are a series of case studies to illustrate different uses of the EPS.

1. DISTRIBUTION OF ELEVATION CLASSES FOR VAFB

Elevation was coded in 200-foot intervals for each grid cell. The highest elevation in the grid cell determined the code assigned to that cell. Using this system, 10 different codes were used to describe the elevation from sea level to the highest point of VAFB. All areas 1800 feet and above were combined into one elevation class. The highest elevation on the base is 2170 feet.

The GRID program was used to display the distribution of the elevation classes on VAFB. Table 1 is a summary of the elevation classes based on GRID display output. The same information could easily be obtained by planimetering the appropriate contours on a topographic map. This case is too simple to display the full power of the EPS, but it is desirable to include for just that reason.

The elevation data, along with other data variables, can be used to study general hydrologic features on the base. A GRID map could be printed to study lowland drainage areas by printing out all the areas with an elevation of less than 600 feet. The areas shown might also indicate areas dominated by coastal fog if 600 feet represents the mean low ceiling (see Volume I, Figure 3.2.3). Similarly, areas below 1200 feet may be consistently below the inversion layer and thus subject to potential effects of the exhaust cloud from a rocket launch (see Volume I, Figure 3.2.4).

2. AREAS SENSITIVE TO EROSION ON VANDENBERG AFB

This study uses the GRID program and data base variables to define areas of high environmental sensitivity to erosion. The soil and vegetation data base variables were used in the study. They are described in detail in Section VIII.

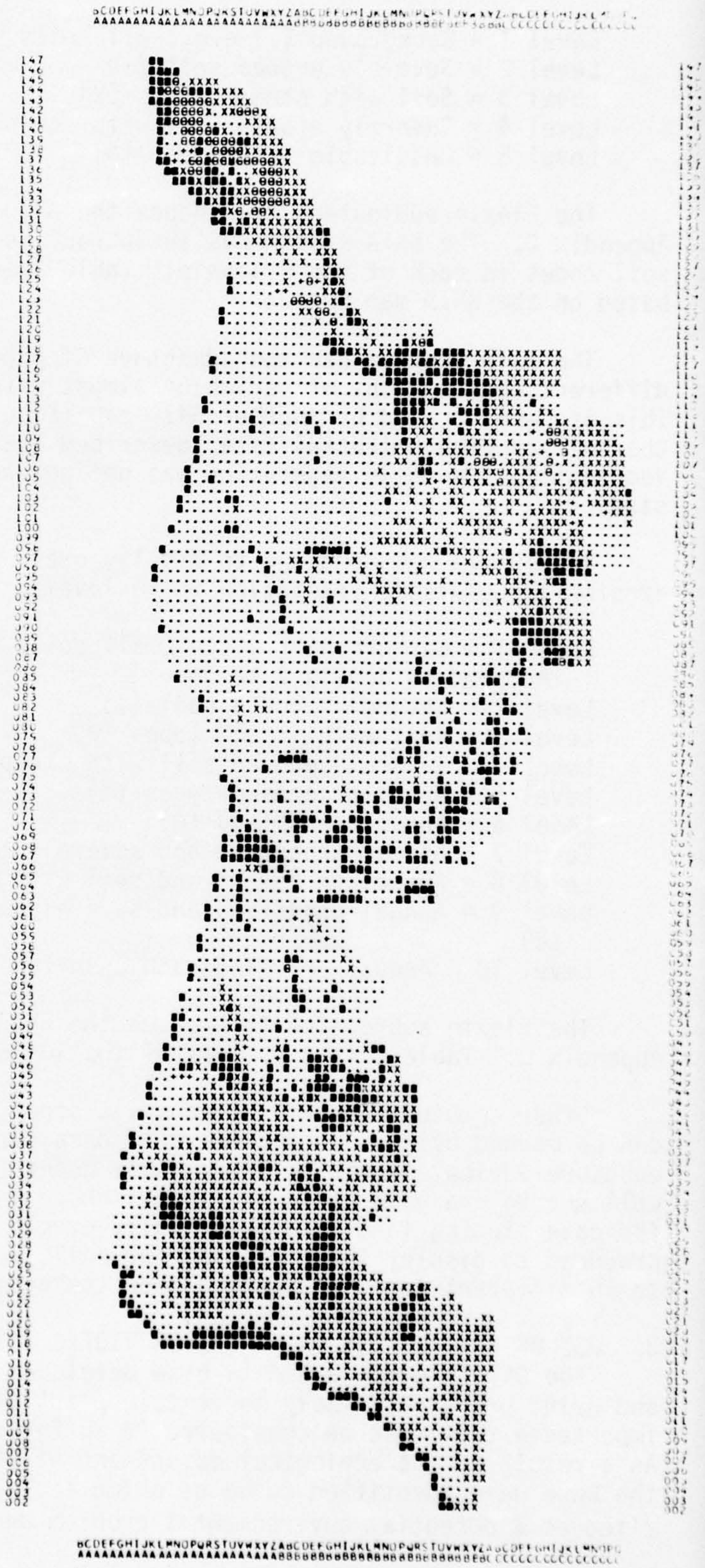
The erosion potential of the soil was analyzed using the soil series/phase or land type with its slope characteristic. Using this procedure, 62 soil codes in the data base were defined to have a high erosion potential. These included the following groups: severely eroded soils, soils with steep slopes (greater than 15 percent), and unsuitable land types (based on engineering restraints). The term "land type" is used to describe areas where the soil materials are too rocky, shallow, severely eroded, sandy, or wet to be classified as distinct soil types. The category "unsuitable land types" includes land types on VAFB judged to be unsuitable for construction purposes based on engineering restraints. Examples of unsuitable land types are: coastal beaches, sedimentary rock land, gullied land, etc.

A GRID map (Figure 1) was produced to display the erosion potential of the soil in 5 levels based on the above criteria. They are:

TABLE 1. SUMMARY OF ELEVATION CLASSES FOR VANDENBERG AIR FORCE BASE, BASED ON GRID DISPLAY OUTPUT.

| Elevation Classes (Feet) | No. of Cells | *Estimated Acres | Percent of Total Cells |
|---|---|---|---|
| 0- 200 | 844 | 19378 | 18.2 |
| 200- 400 | 1339 | 30743 | 28.8 |
| 400- 600 | 963 | 22110 | 20.7 |
| 600- 800 | 528 | 12122 | 11.4 |
| 800-1000 | 406 | 9322 | 8.7 |
| 1000-1200 | 248 | 5694 | 5.3 |
| 1200-1400 | 131 | 3008 | 2.8 |
| 1400-1600 | 88 | 2020 | 1.9 |
| 1600-1800 | 50 | 1148 | 1.1 |
| 1800 and over | 49 | 1125 | 1.1 |
| TOTALS | 4646 | 106670 | 100.0 |

*Estimated acres = no. of cells x 22.96 acres per cell.



LEGEND

BACKGROUND .

SEVERELY ERODED SOIL +

SOIL WITH STEEP SLOPES X

SEVERELY ERODED SOIL WITH STEEP SLOPES θ

UNSUITABLE LAND TYPES ■

FIGURE 1. AREAS WITH SOILS OF HIGH EROSION POTENTIAL ON VAFB.

Level 1 = Background (.) e.g., all soils not classed in levels 2 to 5.
Level 2 = Severely eroded soil (+)
Level 3 = Soil with steep slopes (X)
Level 4 = Severely eroded soil with steep slopes (θ)
Level 5 = Unsuitable land types (■)

The Flexin subroutine to produce the GRID map in Figure 1 is listed in Appendix C. The DATA statements in Subroutine Flexin list the individual soil codes in each of the 5 levels. Table 2 is a summary of the 5 levels based on the GRID map output.

The GRID program has the advantage of producing computer maps displaying different combinations of variables almost without limit at minimal cost. This is demonstrated by another GRID map (Figure 2). This GRID output used the soil erosion potential data (described above) combined with unstable vegetation. Unstable vegetation was defined as annual grassland in this study.

A GRID map was produced to display areas of potentially high soil erosion and unstable vegetation in 10 levels. They are:

Level 1 = Background (.) e.g., all soils and vegetation types not included in levels 2 to 10.
Level 2 = Severely eroded soil (,)
Level 3 = Soil with steep slopes (■)
Level 4 = Severely eroded soil with steep slopes (+)
Level 5 = Unsuitable land types (X)
Level 6 = Annual grassland (O)
Level 7 = Annual grassland and severely eroded soil (θ)
Level 8 = Annual grassland and soil with steep slopes (θ)
Level 9 = Annual grassland and severely eroded soil with steep slopes (⊠)
Level 10 = Annual grassland and unsuitable land types (■)

The Flexin subroutine to produce the GRID map in Figure 2 is listed in Appendix D. Table 3 is a summary of the 10 levels based on GRID output.

Other combinations of eroded soil, steep slopes, and unstable vegetation can be mapped using GRID and the data base variables. For example, the exposure variable contains subvariable codes for multiple exposures in a cell due to drainage areas or ridge lines. These subvariable codes would indicate sloping land with potentially eroded soil. A GRID map could be produced to display the variables for soil, vegetation, and exposure in up to 10 different levels depending upon the design of Subroutine Flexin.

3. USE OF GRID TO DISPLAY AREAS OF BIOTIC SENSITIVITY

The GRID program and data base developed for VAFB can be used to locate and print out areas likely to contain plant or animal species of substantial importance that must be considered in an Environmental Impact Statement. As a result of the ecological assessment of VAFB three vegetation areas on the base were identified to be of prime ecological significance and were cited as a potential environmental problem deserving special consideration

TABLE 2. SUMMARY OF GRID LEVELS DISPLAYING AREAS WITH SOILS OF HIGH EROSION POTENTIAL.

| Level | No. of Cells | Estimated Acres | Percent of Total Cells |
|---|---|---|---|
| 1 | 2648 | 60798 | 57.0 |
| 2 | 25 | 574 | 0.5 |
| 3 | 1152 | 26450 | 24.8 |
| 4 | 89 | 2043 | 1.9 |
| 5 | 732 | 16807 | 15.8 |
| TOTALS | 4646 | 106672 | 100.0 |

TABLE 3. SUMMARY OF GRID LEVELS DISPLAYING AREAS OF HIGH EROSION POTENTIAL BASED ON SOILS AND VEGETATION.

| Level | No. of Cells | Estimated Acres | Percent of Total Cells |
|---|---|---|---|
| 1 | 1674 | 38435 | 36.0 |
| 2 | 8 | 184 | 0.2 |
| 3 | 687 | 15774 | 14.8 |
| 4 | 16 | 367 | 0.3 |
| 5 | 589 | 13523 | 12.7 |
| 6 | 974 | 22363 | 21.0 |
| 7 | 17 | 390 | 0.4 |
| 8 | 465 | 10676 | 10.0 |
| 9 | 73 | 1676 | 1.6 |
| 10 | 143 | 3283 | 3.1 |
| TOTALS | 4646 | 106671 | 100.1 |

LEGEND

| | |
|---|---|
| BACKGROUND | . |
| SEVERELY ERODED SOIL | , |
| SOIL WITH STEEP SLOPES | • |
| SEVERELY ERODED SOIL WITH STEEP SLOPES | + |
| UNSUITABLE LAND TYPES | X |
| ANNUAL GRASSLAND | O |
| ANNUAL GRASSLAND AND SEVERELY ERODED SOIL | θ |
| ANNUAL GRASSLAND AND SOIL WITH STEEP SLOPES | θ |
| ANNUAL GRASSLAND AND SEVERELY ERODED SOIL WITH STEEP SLOPES | ⊠ |
| ANNUAL GRASSLAND AND UNSUITABLE LAND TYPES | ▮ |

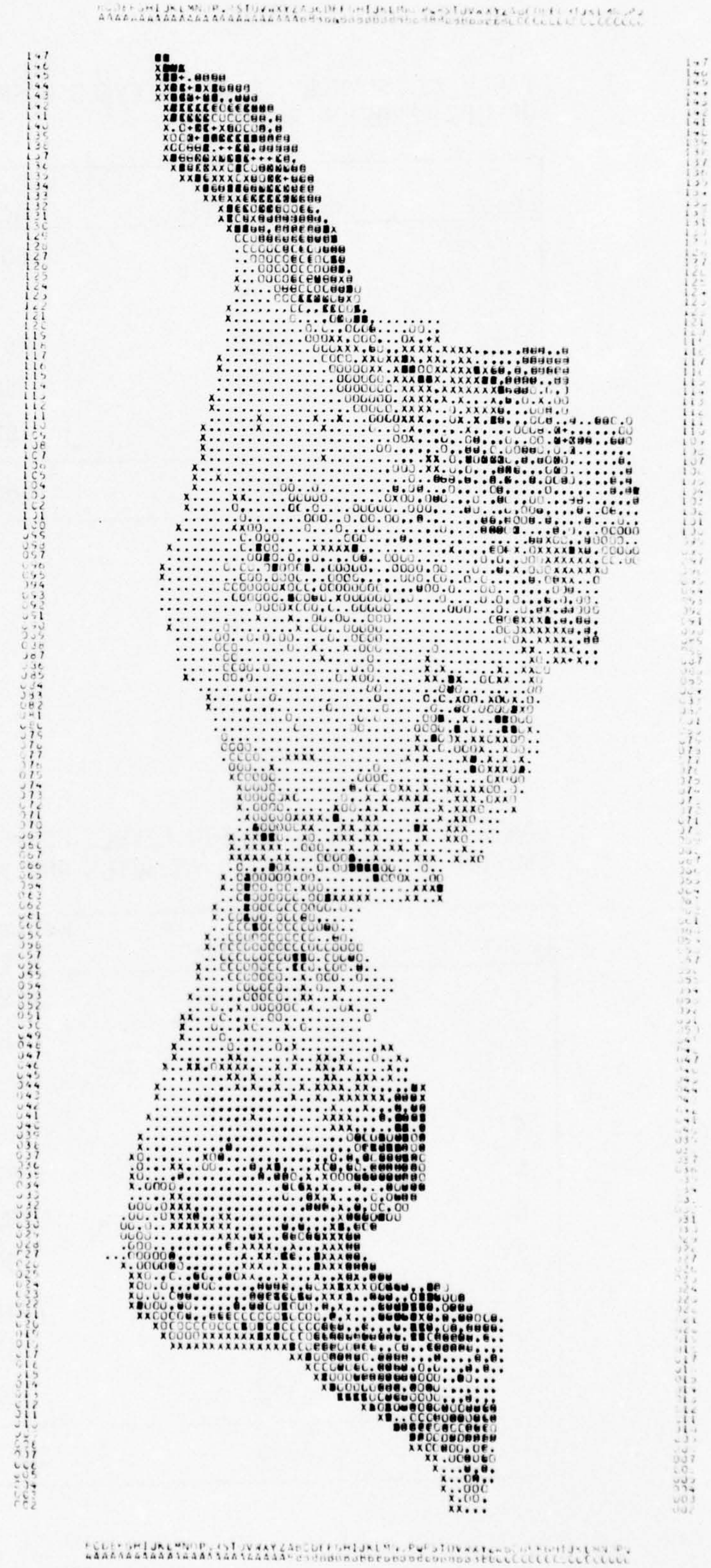


FIGURE 2. AREAS OF HIGH EROSION POTENTIAL BASED ON SOILS AND VEGETATION ON VAFB.

for the STS program (Reference 1). The areas are: Tanbark Oak forest, Bishop Pine forest, and stabilized sand dunes.

Each of the areas above is a vegetation type and is coded as a subvariable in the computerized data base. A GRID map, Figure 3, was produced to display areas of prime ecological significance in 7 levels. They are:

Level 1 = Bishop Pine forest (X)
Level 2 = Tanbark Oak forest (O)
Level 3 = Stabilized sand dunes (■)
Level 4 = Background (.) e.g., all vegetation types not included in levels 1 to 3 or levels 5 to 7
Level 5 = Bishop Pine forest-partial occurrence (+)
Level 6 = Tanbark Oak forest-partial occurrence (θ)
Level 7 = Stabilized sand dunes-partial occurrence (Ø)

The Flexin subroutine to produce the GRID map in Figure 3 is listed in Appendix E. The vegetation subvariables were coded at the 2.55-acre subcell level. Subroutine Flexin was written to direct the computer to read each of the 9 subcells for a grid cell. A routine then calculated the vegetation type of the grid cell using the vegetation type occurring in a majority of the subcells. If the vegetation type was one of the key types, it was mapped as level 1, 2, or 3 for the grid cell. If a key vegetation type was present, but did not occur in the majority of the subcells, it was mapped as level 5, 6, or 7. All other vegetation types were mapped as background. Table 4 is a summary of the 7 levels based on the GRID output.

The GRID map displaying areas of prime ecological significance can also be interpreted to display the distribution of plant species which are characteristic of the vegetation type. For example, 6 rare plant species are restricted to the stabilized sand dunes (Reference 1). Therefore, the 6 rare plant species have a high probability of occurring within grid cells mapped as stabilized sand dunes.

Similarly, the probable distribution of some animals can be mapped based on their habitat preference. The California Legless Lizard (*Anniella pulchra*) is a species regulated by the California Fish and Game Commission. It occurs on VAFB and is considered relatively sensitive due to its habitat specificity (Reference 1).

*A. pulchra* is a burrowing reptile and is relatively restricted to soils it can penetrate. Based on the field studies done at VAFB during the ecological assessment and Miller's research (Reference 5), suitable habitat for *A. pulchra* was described using subvariables in the computerized data base. Suitable habitat for *A. pulchra* included: a suitable soil type (sandy or loamy soils), a preferred vegetation type, or a combination of both.

A GRID map (Figure 4) was produced to display areas of suitable habitat in 10 levels. They are:

LEGEND

BISHOP PINE FOREST X

TANBARK OAK FOREST O

STABILIZED SAND DUNES ▮

BACKGROUND ·

BISHOP PINE FOREST-
PARTIAL OCCURRENCE +

TANBARK OAK FOREST-
PARTIAL OCCURRENCE θ

STABILIZED SAND DUNES-
PARTIAL OCCURRENCE ⊠

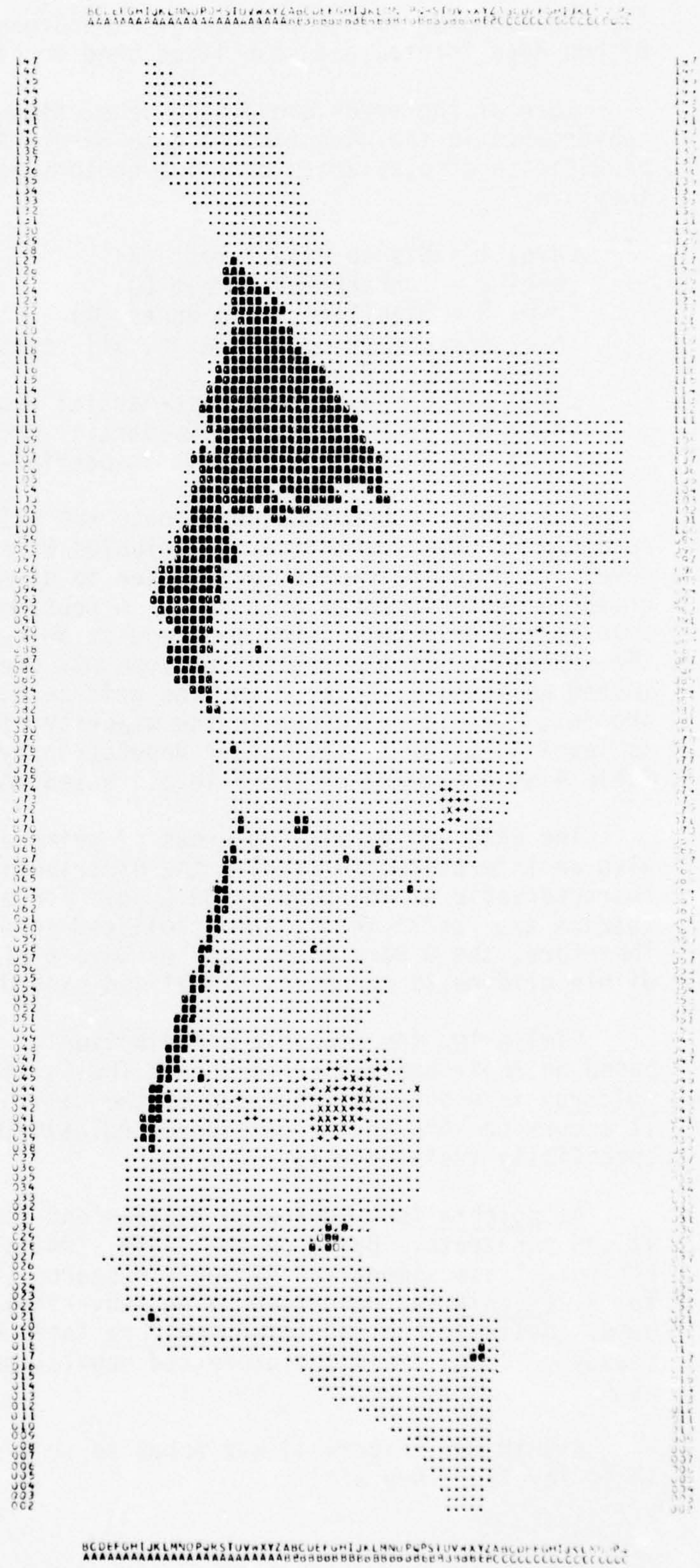


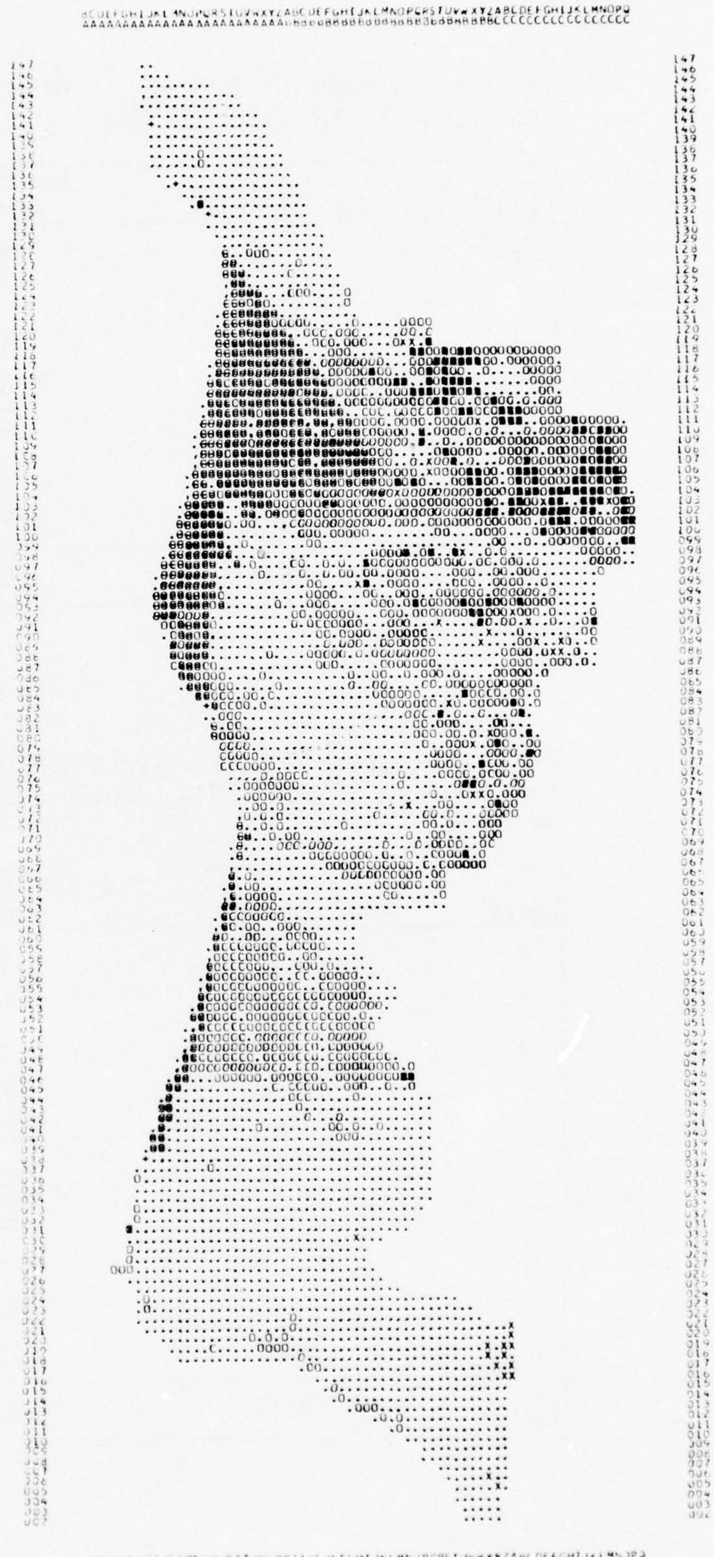
FIGURE 3. AREAS OF PRIME
ECOLOGICAL SIGNIFCANCE ON VAFB.

TABLE 4. SUMMARY OF GRID LEVELS DISPLAYING AREAS OF PRIME ECOLOGICAL SIGNIFICANCE OF VAFB.

| Level | No. of Cells | Estimated Acres | Percent of Total Cells |
|---|---|---|---|
| 1 | 20 | 459 | 0.4 |
| 2 | 2 | 46 | 0.0 |
| 3 | 411 | 9437 | 8.8 |
| 4 | 4032 | 92575 | 86.8 |
| 5 | 45 | 1033 | 1.0 |
| 6 | 9 | 207 | 0.2 |
| 7 | 127 | 2916 | 2.7 |
| TOTALS | 4646 | 106673 | 99.9 |

TABLE 5. SUMMARY OF GRID LEVELS DISPLAYING AREAS OF SUITABLE HABITAT FOR THE CALIFORNIA LEGLESS LIZARD (ANNIELLA PULCHRA) ON VAFB.

| Level | No. of Cells | Estimated Acres | Percent of Total Cells |
|---|---|---|---|
| 1 | 14 | 321 | 0.3 |
| 2 | 15 | 344 | 0.3 |
| 3 | 5 | 115 | 0.1 |
| 4 | 39 | 895 | 0.8 |
| 5 | 1360 | 31226 | 29.3 |
| 6 | 68 | 1561 | 1.5 |
| 7 | 374 | 8587 | 8.0 |
| 8 | 4 | 92 | 0.1 |
| 9 | 146 | 3352 | 3.1 |
| 10 | 2621 | 60178 | 56.4 |
| TOTALS | 4646 | 106671 | 99.9 |



LEGEND

| | |
|---|---|
| COASTAL STRAND | , |
| STABILIZED SAND DUNES | , |
| COASTAL BLUFF | + |
| OAK WOODLAND | X |
| SUITABLE SOIL ASSOCIATIONS | O |
| COASTAL STRAND-SUITABLE SOIL OVERLAP | θ |
| STABILIZED SAND DUNES-SUITABLE SOIL OVERLAP | θ |
| COASTAL BLUFF-SUITABLE SOIL OVERLAP | ⊠ |
| OAK WOODLAND-SUITABLE SOIL OVERLAP | ■ |
| BACKGROUND | . |

FIGURE 4. AREAS OF SUITABLE HABITAT FOR THE CALIFORNIA LEGLESS LIZARD ON VAFB.

Level 1 = Coastal strand (,)
Level 2 = Stabilized sand dunes (■)
Level 3 = Coastal bluff (+)
Level 4 = Oak woodland (X)
Level 5 = Suitable soil associations (O)
Level 6 = Coastal strand/suitable soil overlap (θ)
Level 7 = Stabilized sand dunes/suitable soil overlap (θ)
Level 8 = Coastal bluff/suitable soil overlap (⊠)
Level 9 = Oak woodland/suitable soil overlap (●)
Level 10 = Background (.) e.g., areas of unsuitable habitat.

The Flexin subroutine to produce the GRID map in Figure 4 is listed in Appendix F. The data statement in Subroutine Flexin contains 22 soil codes which were designated as suitable soil associations. Table 5 is a summary of the 10 levels used to display suitable habitat for A. pulchra based on the GRID computer output. The levels of suitable habitat were not ranked in this study, but with expert consultation this could be done.

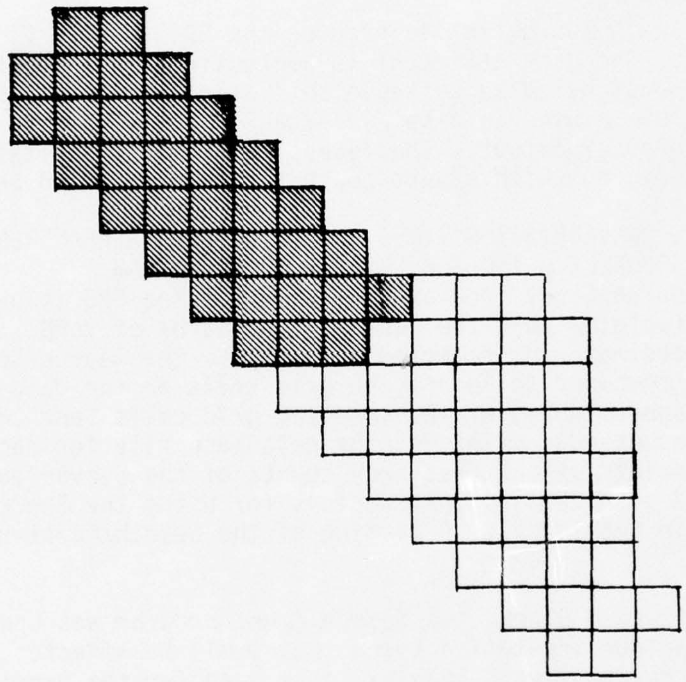
4. EFFECTS ON VEGETATION TYPES DUE TO ALTERNATE PLACEMENTS OF A RUNWAY-LAUNCH COMPLEX USING THE SEARCH/COUNT PROGRAM

The Search/Count program developed for the EPS is useful for making detailed studies within the general study area of VAFB. Given the alphanumeric coordinates of selected grid cells, the Search/Count program will: direct the computer to locate the grid cells in the data base; frequency count the subvariables of the selected grid cells (and convert them to acres if requested); print out the data base file for each selected grid cell; and print out the frequency counts of the subvariables for the group of selected grid cells. Instructions for using the Search/Count program are given in Section VI. A listing of the Search/Count program is given in Appendix G.

In this case study, the Search/Count program was used to compute areas of various vegetation types that would be affected by alternate placements of a runway-launch complex to be used for the proposed Space Transport System (STS). The dimensions of the runway-launch complex are given in the DOD STS Facility Development Specification (Reference 6). The grid cell layout requires that analysis of anything other than exact North-South or East-West layout include adjacent areas.

Figure 5 is a diagram showing the relative positions of the grid cells affected if the runway-launch complex was located on the present runway facility at VAFB with a new runway extension and additional construction of facilities. The darkened grid cells represent the area affected by the runway extension only (34 grid cells). The light area in the diagram represents the existing runway with existing and proposed facilities (43 grid cells).

Table 6 is a summary of the vegetation types affected, at the 2.55-acre subcell resolution, for the proposed runway extension only (dark area of Figure 5) based on the Search/Count program output. Table 7 is a similar summary of the vegetation types affected in the light area of Figure 5.



Shaded grid cells = Area affected by a new runway extension

Unshaded grid cells = Area affected by existing runway with facilities and proposed facilities

FIGURE 5. RELATIVE POSITIONS OF AFFECTED GRID CELLS BY A RUNWAY-LAUNCH COMPLEX LOCATED ON THE PRESENT RUNWAY FACILITY AT VANDENBERG AFB.

TABLE 6. SUMMARY OF THE VEGETATION TYPES AFFECTED BY THE PROPOSED RUNWAY EXTENSION (34 GRID CELLS) BASED ON THE SEARCH/COUNT PROGRAM.

| Vegetation Type | No. of Subcells | Estimated Acres |
|---|---|---|
| Grassland-annual | 48 | 122 |
| Chaparral | 130 | 332 |
| Ruderal vegetation | 72 | 184 |
| Coastal sage scrub-normal phase | 8 | 20 |
| Planted trees | 5 | 13 |
| Chaparral-sparse phase | 34 | 87 |
| Coastal sage scrub-stabilized dune phase | 1 | 3 |
| Man-made facilities | 8 | 20 |
| TOTALS | 306 | 781 |

TABLE 7. SUMMARY OF THE VEGETATION TYPES AFFECTED BY THE EXISTING AND PROPOSED RUNWAY FACILITIES (43 GRID CELLS) BASED ON THE SEARCH/COUNT PROGRAM.

| Vegetation Type | No. of Subcells | Estimated Acres |
|---|---|---|
| Chaparral | 54 | 138 |
| Ruderal vegetation | 256 | 653 |
| Coastal sage scrub-normal phase | 2 | 5 |
| Man-made facilities | 64 | 163 |
| Grassland-annual | 11 | 28 |
| TOTALS | 387 | 987 |

Two alternate configurations of the runway-launch complex are tested to demonstrate the flexibility of using the Search/Count program. Configuration I shows the effect on the various vegetation types if the runway-launch complex was constructed as a mirror image of the previous cell configuration at the same general location of the present runway. Figure 6 shows the relative position of the 77 grid cells for Configuration I. Table 8 is a summary of the vegetation types affected by Configuration I.

Configuration II demonstrates the effect on the various vegetation types if the proposed runway-launch complex was shifted approximately 6000 feet north of the present runway location. The configuration of the affected grid cells is the same as in Figure 5. Table 9 is a summary of the vegetation types affected by Configuration II.

In addition to information on the vegetation types affected, as described in the above examples, the Search/Count program prints out subvariables and frequencies for the soil types, exposure categories, and elevation classes. An infinite variety of configurations for the runway-launch complex (or other developments) can be tested using the Search/Count program depending upon the needs of the user.

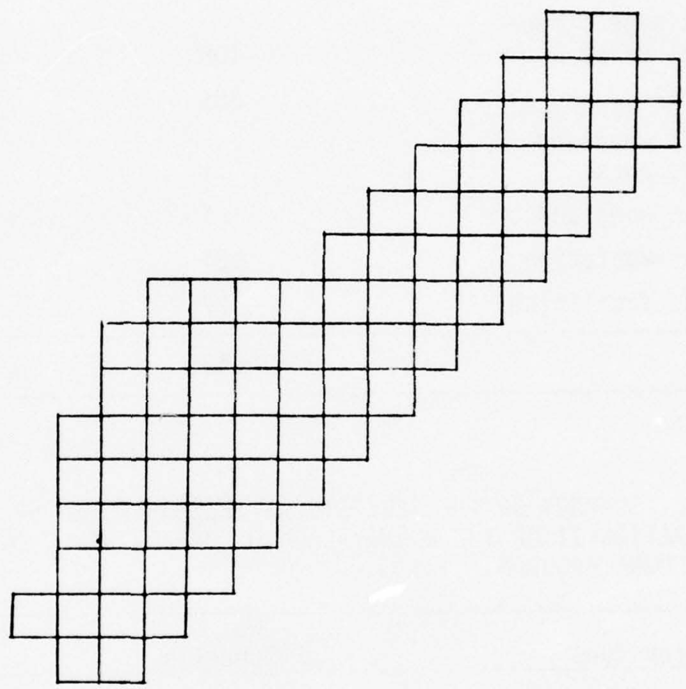


FIGURE 6. RELATIVE POSITIONS OF AFFECTED GRID CELLS FOR CONFIGURATION I OF THE RUNWAY-LAUNCH COMPLEX.

TABLE 8. SUMMARY OF THE VEGETATION TYPES AFFECTED BY CONFIGURATION I OF THE RUNWAY-LAUNCH COMPLEX BASED ON THE SEARCH/COUNT PROGRAM.

| Vegetation Type | No. of Subcells | Estimated Acres |
|---|---|---|
| Grassland-annual | 120 | 306 |
| Coastal sage scrub-normal phase | 108 | 275 |
| Chaparral | 285 | 727 |
| Riparian woodland-sparse phase | 1 | 3 |
| Riparian woodland | 1 | 3 |
| Ruderal vegetation | 151 | 385 |
| Man-made facilities | 27 | 69 |
| TOTALS | 693 | 1768 |

TABLE 9. SUMMARY OF THE VEGETATION TYPES AFFECTED BY CONFIGURATION II OF THE RUNWAY-LAUNCH COMPLEX BASED ON THE SEARCH/COUNT PROGRAM.

| Vegetation Type | No. of Subcells | Estimated Acres |
|---|---|---|
| Coastal sage scrub-stabilized dune phase | 27 | 69 |
| Grassland-annual | 276 | 704 |
| Coastal sage scrub-normal phase | 113 | 288 |
| Ruderal vegetation | 14 | 36 |
| Chaparral | 250 | 637 |
| Planted trees | 4 | 10 |
| Riparian woodland | 2 | 5 |
| Riparian woodland-sparse phase | 1 | 3 |
| Man-made facilities | 6 | 15 |
| TOTALS | 693 | 1767 |

## SECTION V

## COMPARISON OF MANUAL AND AUTOMATED METHODS FOR DETERMINING AREAS OF VEGETATION

The purpose of this study is to test several methods for manually determining areas of vegetation and statistically compare them to automated methods using the digitized data base. Three different scales of analysis were used to compare selected areas of vegetation -- two manual methods and one automated method.

### 1. MANUAL METHODS

Two manual methods were used for determining areas of vegetation in the following study:

a. cutting and weighing method
b. planimeter method

The overlay vegetation maps made for the C series of maps in the Base Master Plan (Reference 4) were used in the study.

### 2. CUTTING AND WEIGHING METHOD

The cutting and weighing method involves cutting out (from a copy of the vegetation map) each distinct area of vegetation and weighing the combined pieces of each vegetation type. The weight of each vegetation type is then compared with the known weight and area of the vegetation map to calculate the area of each vegetation type. A sensitive balance ($\pm$ 0.0001 gram) must be used to accurately weigh the pieces of the map.

The following procedure was used with Vegetation Map Sheet No. 61 using the cutting and weighing method:

a. Determine the total area of the map sheet.
b. Weigh the whole map sheet.
c. Cut out the individual areas of vegetation with a sharp razor blade or knife.
d. Weigh the combined pieces of each vegetation type.
e. Calculate the areas of each vegetation type by equating the area and weight of the whole map with the individual weights of each vegetation type.

Table 10 is a summary of the cutting and weighing method analysis for Vegetation Map Sheet No. 61. The areas calculated by the cutting and weighing method compare rather closely to those planimetered for the same map sheet (see Table 11).

The cutting and weighing method has several disadvantages when compared to the planimeter method:

a. It takes longer (depending on the number of areas to be cut and their irregularity).
b. There are more calculations and measurements required to estimate the unknown areas.

TABLE 10. AREAS OF VEGETATION BY THE CUTTING AND WEIGHING METHOD FOR VEGETATION MAP SHEET NO. 61.

| Vegetation Code No.* | Weight (Grams) | Estimated Area (Square Inches) | Estimated Area (Acres) |
|---|---|---|---|
| 25 | 0.0052 | 0.12 | 2 |
| 9 | 0.0046 | 0.10 | 2 |
| 12 | 0.0180 | 0.41 | 7 |
| 118 | 0.0338 | 0.77 | 14 |
| 6 | 0.0746 | 1.71 | 31 |
| 00 | 1.7802 | 40.73 | 736 |
| 19 | 0.0017 | 0.04 | 1 |
| 5 | 0.0153 | 0.35 | 6 |
| 7 | 1.0607 | 24.27 | 439 |
| 16 | 3.1711 | 72.56 | 1312 |
| UND** | 0.0169 | 0.39 | 7 |
| TOTALS | 6.1821 | 141.45 | 2557 |

Weight of whole map = 6.1825 grams

Area of whole map = 141.47 square inches

Total time for analysis = 3.5 hours

*See Section VII

**Undetermined vegetation types

TABLE 11. PLANIMETER SUMMARY FOR VEGETATION MAP SHEET NO. 61.

| Vegetation Code No.* | Area (Square Inches) | Estimated Area (Acres) |
|---|---|---|
| UND** | 0.44 | 8 |
| 12 | 0.40 | 7 |
| 16 | 73.05 | 1321 |
| 18 | 0.65 | 12 |
| 5 | 0.33 | 6 |
| 6 | 2.05 | 37 |
| 19 | 0.02 | 0 |
| 9 | 0.13 | 2 |
| 7 | 24.18 | 437 |
| 00 | 41.21 | 745 |
| 25 | 0.12 | 2 |
| TOTALS | 142.70 | 2577 |

Total time for analysis = 3.2 hours

*See Section VII

**Undetermined vegetation types

c. A copy of the map must be sacrificed to the procedure.
d. It is extremely tedious work.

Because of the reasons given above, the cutting and weighing method is unsuitable for determining areas of vegetation in large scale studies.

3. PLANIMETER METHOD

The planimeter method was the second manual method used for determining areas of vegetation in this study. The planimeter used was calibrated to give area measurements in square inches. Of the two manual methods tested, the planimeter method was easier and quicker. Four selected map sheets were planimetered for use in later analyses. Tables 11, 12, 13, and 14 summarize the planimeter data for the four map sheets.

An advantage of using the planimeter method over automated methods is that the display is in a form familiar to those accustomed to reading maps. Disadvantages of using the planimeter method over automated methods are:

a. Cost and time of preparing and planimetering overlay combinations limit the number of closely related alternatives that can be evaluated and displayed.
b. Too many overlays put on top of one another quickly get confusing unless irrelevant elements are screened out, which is difficult with conventional cartography.

4. AUTOMATED METHOD

The GRID computer graphics program was the automated method used for determining and displaying areas of vegetation in this study. The Search/Count program and the Small Cell Count program were used with the data base to independently determine areas for computation. Listings of the Search/Count program and the Small Cell Count program are given in Appendixes G and H.

Advantages of the automated method over manual methods are:

a. Combinations of overlays for displaying alternatives can be produced almost without limit.
b. The cost is minimal once the data base and the computer graphics program are established.

Disadvantages of the automated method include:

a. The display may look crude and unattractive to the unaccustomed user.
b. The resolution is not as fine as with the manual method.

5. INVESTIGATION OF THREE DIFFERENT SCALES OF ANALYSIS

This study compares areas of vegetation on four selected map sheets using:

a. Planimeter
b. Small Cell Count program (2.55-acre grid cells)
c. GRID (aggregated to 23 acres)

TABLE 12. PLANIMETER SUMMARY FOR VEGETATION MAP SHEET NO. 28.

| Vegetation Code No. * | Area (Square Inches) | Estimated Area (Acres) |
|---|---|---|
| 18 | 2.96 | 54 |
| UND** | 2.25 | 41 |
| 6 | 17.79 | 322 |
| 9 | 0.34 | 6 |
| 16 | 63.57 | 1149 |
| 5 | 49.31 | 891 |
| 19 | 1.10 | 20 |
| 4 | 3.13 | 57 |
| 3 | 0.32 | 6 |
| 23 | 0.83 | 15 |
| 22 | 0.01 | 0 |
| TOTALS | 141.61 | 2561 |

Total time for analysis = 6.0 hours

*See Section VII

**Undetermined vegetation types

TABLE 13. PLANIMETER SUMMARY FOR VEGETATION MAP SHEET NO. 41.

| Vegetation Code No.* | Area (Square Inches) | Estimated Area (Acres) |
|---|---|---|
| 12 | 0.26 | 5 |
| 13 | 9.14 | 165 |
| 6 | 11.94 | 216 |
| 16 | 57.22 | 1034 |
| 14 | 0.32 | 6 |
| 17 | 3.80 | 69 |
| 5 | 14.91 | 270 |
| 25 | 0.11 | 2 |
| 22 | 4.14 | 75 |
| 52 | 2.06 | 37 |
| 4 | 15.90 | 287 |
| 18 | 4.79 | 87 |
| 23 | 1.93 | 35 |
| 9 | 0.05 | 1 |
| UND** | 1.35 | 24 |
| 20 | 13.42 | 243 |
| 19 | 0.34 | 6 |
| 42 | 0.41 | 7 |
| TOTALS | 142.09 | 2569 |

Total time for analysis = 4.5 hours

*See Section VII

**Undetermined vegetation types

TABLE 14. PLANIMETER SUMMARY FOR VEGETATION MAP SHEET NO. 62.

| Vegetation Code No.* | Area (Square Inches) | Estimated Area (Acres) |
|---|---|---|
| 7 | 43.40 | 785 |
| 16 | 91.40 | 1652 |
| 6 | 4.74 | 86 |
| 9 | 1.02 | 18 |
| 5 | 0.78 | 14 |
| 52 | 0.95 | 17 |
| 00 | 0.10 | 2 |
| 19 | 0.05 | 1 |
| UND** | 0.09 | 2 |
| 22 | 0.13 | 2 |
| TOTALS | 142.66 | 2579 |

Total time for analysis = 4.0 hours

*See Section VII

**Undetermined vegetation types

The map sheets used in the study are described in Section V #3. The Small Cell Count program was simulated for the map sheets by tallying the vegetation types in the 2.55-acre grid cells from a printout of the data base. GRID (aggregated to 23-acre cells) was simulated using the same procedure. The vegetation type of the center subcell determined the vegetation type for the 23-acre grid cell.

The grid cell counts were converted to acres for comparison of areas of vegetation for the three scales of analysis. Table 15 is the pooled data of the four vegetation map sheets. The vegetation types were ranked from largest to smallest in numbers of acres, using the estimated acres planimetered for each vegetation type. The percent deviation (small cells) was computed by the following formula:

percent deviation (small cells) =

$$\frac{\text{acres (small cells) - acres (planimetered)}}{\text{acres (planimetered)}} \times 100 \text{ percent}$$

Acres computed for the planimetered data were assumed to be more accurate than acres computed by the grid method.

The percent deviation (large cells) was computed by a similar formula:

percent deviation (large cells) =

$$\frac{\text{acres (large cells) - acres (planimetered)}}{\text{acres (planimetered)}} \times 100 \text{ percent}$$

Comparing the percent deviations for both the small and large cells gives a common trend of less deviations between the three scales of analysis for estimating large areas. As the area decreases, the percent deviations increase for both the small cell and large cell grid data. For this particular study, there was less than 7 percent deviation between the three different scales of analysis for areas greater than 1200 acres.

The weighted mean deviation was used to compare the percent deviation (small cells) to the percent deviation (large cells) when their values were weighted by using the planimeter estimated acres for each vegetation type. The weighted mean deviation was calculated by the following formula:

$$\text{weighted mean deviation} = \frac{\Sigma(\text{acres (planimetered)} \times |\text{percent deviation}|)}{\Sigma\text{acres (planimetered)}}$$

Using the data in Table 15, the following values were calculated:

weighted mean deviation (small cells) = 3.3
weighted mean deviation (large cells) = 7.1

The above values indicate that overall, there is more variability when estimating acres of vegetation using the aggregated 23-acre GRID cell, as compared to the small cell count method.

TABLE 15. POOLED DATA OF FOUR VEGETATION MAP SHEETS USING THREE DIFFERENT SCALES OF ANALYSIS.

| Vegetation Type (Code No.)* | Planimeter Estimated Acres | Small Cells Estimated Acres | Percent Deviation Small Cells | Large Cells Estimated Acres | Percent Deviation Large Cells |
|---|---|---|---|---|---|
| 16 | 5157 | 5182 | 0.5 | 5250 | 2.4 |
| 7 | 1222 | 1242 | 1.6 | 1240 | 1.5 |
| 5 | 1181 | 1247 | 5.6 | 1263 | 6.9 |
| 00 | 747 | 719 | -3.7 | 620 | -17.0 |
| 6 | 660 | 701 | 6.2 | 735 | 11.4 |
| 4 | 344 | 367 | 6.7 | 344 | 0.0 |
| 20 | 243 | 237 | -2.5 | 230 | -5.3 |
| 13 | 165 | 173 | 4.8 | 230 | 39.4 |
| 18 | 152 | 130 | -14.5 | 161 | 5.9 |
| 22 | 77 | 64 | -16.9 | 23 | -70.1 |
| 17 | 69 | 61 | -11.6 | 23 | -66.7 |
| 52 | 54 | 36 | -33.3 | 46 | -14.8 |
| 23 | 50 | 59 | 18.0 | 46 | -8.0 |
| 9 | 28 | 0 | -100.0 | 0 | -100.0 |
| 19 | 27 | 23 | -14.8 | 0 | -100.0 |
| 12 | 12 | 13 | 8.3 | 23 | 91.7 |
| 42 | 7 | 3 | -57.1 | 0 | -100.0 |
| 3 | 6 | 0 | -100.0 | 0 | -100.0 |
| 14 | 6 | 8 | 33.3 | 0 | -100.0 |
| 25 | 4 | 10 | 150.0 | 23 | 475.0 |
| 8 | 0 | 8 | -- | 0 | -- |
| UND** | 75 | -- | -- | -- | -- |
| TOTALS | 10286 | 10283 | | 10287 | |

*See Section VII

**Undetermined vegetation types (from vegetation map sheets)

Weighted mean deviation (small cells) = 3.3

Weighted mean deviation (large cells) = 7.1

The nonparametric Spearman rank correlation method (Reference 7) was used to compare the pooled data in Table 15. The computing formula for the Spearman rank correlation coefficient is:

$$r_s = \frac{1 - 6\Sigma d_i^2}{n^3 - n}$$

The value of $r_s$ may range from -1 to +1. The interpretation of $r_s$ is that as its value approaches +1, the two groups have increasingly similar rank correlation.

Two Spearman rank correlation tests were performed on the data in Table 15. In the first test, acres (planimetered) were compared to acres (small cells) for the different vegetation types. The calculated value of $r_s$ is:

$$r_s = 0.958$$

In the second test, acres (planimetered) were compared to acres (large cells) for the different vegetation types. The calculated value is:

$$r_s = 0.920$$

Both tests showed highly significant rank correlations. The critical value of the Spearman rank correlation coefficient for the above two tests is:

$$r_{s.05(2)20} = 0.447 \qquad P < 0.001$$

The interpretation which can be made from the Spearman rank correlation tests above is that both methods of estimating areas of vegetation (small cell and large cell), when compared to planimetered areas, show highly significant correlation when their areas are ranked. The percent deviation of the planimetered areas from the small cell and large cell areas must be considered to view the Spearman rank correlation test in perspective.

6. COMPARISON OF THE SMALL CELL COUNT PROGRAM AND GRID

This study compares areas of vegetation for the entire base as estimated by the small cell (subcell) count program and GRID (aggregated to 23-acre cells). Two different aggregation methods were used. In the first method, the computer was directed to determine the predominant vegetation type of a grid cell from the vegetation types of the nine subcells. In the second method, the computer was directed to determine the vegetation type for a grid cell by using the vegetation type of the center subcell. Table 16 summarizes the data. The grid cell counts were converted to acres for comparison.

The vegetation types in Table 16 were ranked from largest to smallest (in numbers of acres) using estimated acres by small cells. The differences between the totals for both GRID methods was due to rounding error.

Percent deviation was computed by the formula:

TABLE 16. AREAS OF VEGETATION FOR VANDENBERG AFB.

| Vegetation Type (Code No.)* | Small Cells Estimated Acres | GRID (Majority) Estimated Acres | Percent Deviation GRID (Majority) | GRID (Center) Estimated Acres | Percent Deviation GRID (Center) |
|---|---|---|---|---|---|
| 16 | 38610 | 39422 | 2.1 | 38389 | -0.6 |
| 6 | 19337 | 19746 | 2.1 | 19103 | -1.2 |
| 5 | 14359 | 14671 | 2.2 | 14350 | -0.1 |
| 8 | 9091 | 9092 | 0.0 | 8931 | -1.8 |
| 3 | 4149 | 4294 | 3.5 | 4248 | 2.4 |
| 23 | 3815 | 3697 | -3.1 | 3903 | 2.3 |
| 7 | 3302 | 3421 | 3.6 | 3398 | 2.9 |
| 18 | 2512 | 2388 | -4.9 | 2663 | 6.0 |
| 00 | 2259 | 1010 | -55.3 | 2319 | 2.7 |
| 20 | 1907 | 1975 | 3.6 | 1929 | 1.2 |
| 12 | 1658 | 1676 | 1.1 | 1883 | 13.6 |
| 4 | 1617 | 1561 | -3.5 | 1676 | 3.6 |
| 42 | 436 | 390 | -10.6 | 528 | 21.1 |
| 24 | 431 | 436 | 1.2 | 321 | -25.5 |
| 72 | 357 | 253 | -29.1 | 298 | -16.5 |
| 14 | 352 | 321 | -8.8 | 321 | -8.8 |
| 99 | 321 | 321 | 0.0 | 321 | 0.0 |
| 52 | 283 | 184 | -35.0 | 321 | 13.4 |
| 13 | 280 | 321 | 14.6 | 321 | 14.6 |
| 19 | 273 | 298 | 9.2 | 184 | -32.6 |
| 25 | 255 | 253 | -0.8 | 230 | -9.8 |
| 1 | 227 | 207 | -8.8 | 321 | 41.4 |
| 22 | 194 | 184 | -5.2 | 161 | -17.0 |
| 17 | 166 | 161 | -3.0 | 115 | -30.7 |
| 11 | 158 | 115 | -27.2 | 207 | 31.0 |
| 9 | 127 | 161 | 26.8 | 92 | -27.6 |
| 2 | 61 | 46 | -24.6 | 69 | 13.1 |
| 26 | 43 | 46 | 7.0 | 46 | 7.0 |
| 62 | 33 | 0 | -100.0 | 23 | -30.3 |
| 10 | 8 | 0 | -100.0 | 0 | -100.0 |
| TOTALS | 106621 | 106650 | | 106671 | |

*See Section VII

Weighted mean deviation GRID (majority) = 3.7

Weighted mean deviation GRID (center) = 2.1

$$\text{percent deviation} = \frac{\text{acres(GRID)} - \text{acres(small cells)}}{\text{acres(small cells)}} \times 100 \text{ percent}$$

Acres computed by the small cell count method were assumed to be more accurate than acres computed by the aggregated GRID method. Comparing the three methods, there is less than 4 percent deviation for areas decreasing to 3500 acres. In general, the percent deviations increase as the areas of the vegetation types decrease.

The weighted mean deviation was used to compare the percent deviation GRID (majority) to the percent deviation GRID (center) when their values were weighted by using the small cells estimated acres for each vegetation type in Table 16. See Section V #5 for the computing formula for the weighted mean deviation.

Using the data in Table 16, the following values were calculated:

weighted mean deviation GRID (majority) = 3.7
weighted mean deviation GRID (center) = 2.1

The values above indicate that there is more overall variability for estimating acres of vegetation using estimated acres GRID (majority) compared to estimated acres GRID (center).

The nonparametric Spearman rank correlation method was used to compare areas of vegetation for the entire base as estimated by small cells and the aggregated GRID method. Two Spearman rank correlation tests were performed on the data in Table 16. In the first test, acres (small cells) were compared to acres (GRID, aggregated by the majority of subcells) for the different vegetation types. The calculated value of $r_s$ is:

$$r_s = 0.983$$

In the second test, acres (small cells) were compared to acres (GRID, aggregated by the center subcell vegetation type). The calculated value is:

$$r_s = 0.980$$

The calculated values of $r_s$ in both tests showed highly significant rank correlations. The critical value of $r_s$ for the above two tests is:

$$r_{s.05(2)30} = 0.362 \qquad P < 0.001$$

The interpretation from the Spearman rank correlation tests is that both GRID methods of estimating areas of vegetation for the entire base when compared to areas computed by the small cell method show highly significant correlation when their areas are ranked. The calculated Spearman rank correlation coefficients are almost identical for the two comparisons.

The percent deviations for the two aggregation methods show close similarity, especially for the larger areas. As the areas decrease, departures from the areas estimated by small cells increase. The aggregated

GRID method by the majority of subcells seems to be the most severely affected. This is probably due to the patchiness of the scarce vegetation types.

The best aggregation method to display vegetation for GRID studies, based on the data in Table 16, is the center subcell method. This method can be modified to more accurately display areas of scarce vegetation (less than 200 acres) by having GRID display areas of partial occurrence of the scarce vegetation types. More research is needed on this aspect of aggregation.

## SECTION VI

## USERS MANUAL

1. INTRODUCTION

The following Users Manual is written specifically for the use of the GRID computer graphics program and the Search/Count program with the environmental data base developed for VAFB. The GRID Manual (Reference 8) was used as a key reference in writing sections of this Users Manual pertaining to GRID.

The GRID program was developed at the Harvard Laboratory for Computer Graphics and Spatial Analysis. It provides an efficient means for the graphic display of large quantities of information collected on the basis of a rectangular coordinate grid. It has the capacity of manipulating up to 10,000 different grid cells.

The Search/Count program is essentially a frequency counting program. It can be used in conjunction with GRID or independently to locate and print out data base variables for selected grid cells.

GRID and the Search/Count program are written in FORTRAN IV. They are operational on the IBM 360 computer at San Diego State University and the Burroughs 3500 computer at VAFB. The computer programs in the EPS are designed for computer users rather than computer programmers. They require the user to have a basic knowledge of FORTRAN IV.

Complete listings for the GRID program and the Search/Count program are given in Appendixes A and G. Examples in the Users Manual and programs listings in the appendixes are specifically adapted for the Burroughs 3500 computer. The user is advised to consult with a programmer to adapt the computer programs to other computer systems.

2. BASIC PRINCIPLES OF GRID

The GRID program associates a data value with a cell on a grid. The program processes the data in the order in which it prints the map. Therefore, the data must be in correct order. The program begins processing the data starting with the grid cell in the northwest corner of the map and continues horizontally row by row and from left to right in each row. The numbers below represent the order in which the first 40 grid cells are processed and printed for GRID maps of VAFB:

```
1 2
3 4 5 6
7 8 9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24 25 26 27
28 29 30 31 32 33 34 35 36 37 38 39 40
```

To obtain a map, the user must provide the following packages or sets of instructions: Subroutine Flexin, Irregular Outline Package, Map Package, and Data Input Package.

3. SUBROUTINE FLEXIN

Flexin is the FORTRAN subroutine in GRID which is modified by the user to produce a map. Flexin is called by the main program once for each data cell that is mapped. The user specifies two sets of instructions in Flexin:

a. Where the data value is located on the data card or tape.
b. What analysis, if any, is to be performed on the data variable or variables to derive the value that is mapped.

The subroutine statement for Flexin is:

```
SUBROUTINE FLEXIN( IFORM, T, FIRST )
```

The variables IFORM and FIRST are carried into the subroutine as control variables. The data value to be mapped is carried back to the main program as T (once for every value to be mapped). T is mapped according to the instructions specified in the Map Package. The following examples (1, 2 and 3) demonstrate the use of IFORM and T. The variable FIRST can be used as a logical variable in Subroutine Flexin. It is true on the first entry to Flexin and false on all other entries from the main program. This use of FIRST is automatically set in the GRID program outside of Subroutine Flexin.

Example 1 shows how to use Flexin to map the elevation data coded for VAFB. This is a relatively simple use of Flexin.

Example 1:
A Simple Use of Subroutine Flexin

```
SUBROUTINE FLEXIN ( IFORM, T, FIRST )
READ(11,1) EL
1 FORMAT( 16X, F1.0)
T = EL
RETURN
END
```

This subroutine instructs the computer to read the variable EL from the data tape. The FORMAT statement specifies where the variable is on the data tape. The fourth statement assigns the variable T the elevation value assigned to variable EL. The elevation value to be mapped for the grid cell is returned to the main program as the value of T in the subroutine statement. Flexin is called once for each grid cell that is mapped. A new value for T is read and returned to the main program for the value to be mapped for each grid cell. T is mapped according to instructions given in the Map Package. For example, the Map Package could be set up to map the elevation data into 10 levels -- for the 10 possible elevation codes.

Example 2 shows how to use Flexin in a more detailed analysis to produce a map which will display areas of suitable habitat for the California Legless Lizard. Both the soil and vegetation data were used in making the map. Figure 4 shows the GRID map for this example.

Example 2:
A Complex Use of Subroutine Flexin

```
                                                                Explanatory Notes

      SUBROUTINE FLEXIN(IFORM, T, FIRST)
      REAL SOIL(22)                                                     a.
      DATA SOIL/4.,5.,6.,25.,28.,59.,60.,63.,64.,76.,113.,
     1114.,133.,134.,138.,168.,170.,206.,207.,208.,217.,71./            b.
      NTYPE= 22
      READ(11,11) S,V                                                   c.
   11 FORMAT(3X,F3.0,30X,F2.0)
      T=10.                                                             d.
      DO 300  J= 1,NTYPE
      IF(S.EQ.SOIL(J)) GO TO 450
  300 CONTINUE
      IF(V.EQ.12.) T= 1.
      IF(V.EQ.8.) T=2.
      IF(V.EQ.11.) T=3.
      IF(V.EQ.3) T=4.
      IF(V.EQ.31.) T=4.
      GO TO 500
  450 IF(V.NE.12.) T=5.
      IF(V.NE.8.) T=5.
      IF(V.NE.11.) T=5.
      IF(V.NE.3.) T=5.
      IF(V.NE.31.) T=5.
      IF(V.EQ.12.) T=6.
      IF(V.EQ.8.) T=7.
      IF(V.EQ.11.) T=8.
      IF(V.EQ.3.) T=9.
      IF(V.EQ.31.) T=9.                                                 e.
  500 CONTINUE
      RETURN
      END
```

Explanatory Notes for Example 2:

a. This statement creates storage space for 22 soil codes.

b. Twenty-two soil types were identified as suitable for the Legless Lizard. These soil codes are entered into the storage spaces created in a.

c. A soil code and vegetation code are read for a grid cell from the data tape.

d. The remainder of the subroutine compares criteria for a suitable habitat for the Legless Lizard with each vegetation and soil code in the data base. Ten different levels were selected for printing the map. Each grid cell is classified into one of the levels based on its vegetation and soil codes. The level is returned to the main program as the value of T. The levels for suitable habitat are:

Level 1 = Coastal strand vegetation
Level 2 = Coastal sage scrub-stabilized dune phase vegetation
Level 3 = Coastal bluff vegetation
Level 4 = Oak woodland vegetation

Level 5 = Suitable soil associations
Level 6 = Coastal strand/suitable soil overlap
Level 7 = Coastal sage scrub-stabilized dune phase/suitable soil overlap
Level 8 = Coastal bluff/suitable soil overlap
Level 9 = Oak woodland/suitable soil overlap
Level 10 = Areas which are not suitable habitat for the Legless Lizard

e. Once the value of T is determined for a grid cell in Subroutine Flexin, it is mapped according to instructions provided in the Map Package.

Example 3 shows a relatively simple use of the control variable IFORM, if more than one map is desired with one computer submission. In this example, the computer is directed to produce two maps.

Example 3:
Use of IFORM With Subroutine Flexin

```
                                                      Explanatory Notes
      GO TO ( 1, 2 ), IFORM                                  a.
    1 CONTINUE                                               b.
      READ(11,15) EL                                         c.
   15 FORMAT( 16X,F1.0)
      T = 2.
      IF EL.EQ. 0. T=1.
      IF EL.EQ. 1. T=1.
      IF EL.EQ. 2. T=1.
      RETURN
    2 CONTINUE                                               d.
      READ(11,15) EL
      T=2.
      IF EL.EQ.6. T=1.
      IF EL.EQ.7. T=1.
      IF EL.EQ.8. T=1.
      IF EL.EQ.9. T=1.
      RETURN
      END
```

Explanatory Notes for Example 3:

a. The variable IFORM is carried into the subroutine as a control variable. The value to be mapped is carried back to the main program as T (Flexin is called once for every value to be mapped).

b. Since 2 maps are to be made, Flexin is split into 2 segments. The variable IFORM is given its value in Elective 2, field 1 of the Map Package for each map. Two map packages are required to produce 2 maps. After reading the GO TO statement, the program jumps to the statement N CONTINUE, where N is the value of IFORM. If IFORM equals 2, as specified in the Map Package, the program will execute statement 2 CONTINUE and the statements following it.
In Example 3 there are only 2 routines in Subroutine Flexin. By extending the GO TO statement, as many routines as needed may be used. Each routine is sandwiched between a CONTINUE statement (which indicates the beginning of each routine) and a RETURN statement (which sends the value T back to the main program).

c. This routine instructs the computer to produce a map displaying elevation in 2 levels. Level 1 displays all grid cells coded from zero to 600 feet. Level 2 displays all grid cells coded at elevations greater than 600 feet.

d. This routine instructs the computer to produce a map displaying elevation in 2 levels. Level 1 displays all grid cells at 1200 feet or greater. Level 2 displays all grid cells less than 1200 feet.

4. IRREGULAR OUTLINE PACKAGE

This data set specifies the shape of the outline for the grid map. The irregular outline data determine the number of cells from the left and right sides of the map, in each row, that are left blank. The following data cards are used to make the Irregular Outline Package:

a. On the first card, IRREGULAR OUTLINE, is punched in columns 1-17.
b. On the last card, 99999, is punched in columns 1-5.
c. Between the first and last card, a series of cards with the following format are punched:
   (1) In columns 1-5, the number of successive rows for which the format is repeated.
   (2) In columns 6-10, the number of blank cells at the beginning of the row.
   (3) In columns 11-15, the number of blank cells at the end of the row.

The numbers above must be punched as integer numbers. They must be right justified and contain no decimal points. The program processes the cards in order. The first card refers to the top row (or rows, as specified in columns 1-5). The second card refers to the second row (or rows) etc.

The irregular outline is the first package to prepare in doing a GRID study. The irregular outline for VAFB was prepared from the Base Master Plan maps (Reference 4) and U.S. Geological Survey maps. The C-1.2 series of the Base Master Plan maps are blocked into 1000-foot grid cells. This made it relatively easy to determine the irregular outline to enclose the base boundaries.

Once the irregular outline was determined, it was coded on to coding forms and the data cards were keypunched. The irregular outline data deck contains 102 data cards to specify the 146 rows of grid cells used for the VAFB GRID map. Example 4 shows how the data deck is arranged for the VAFB irregular outline. See Appendix B for the complete listing of the VAFB irregular outline.

Example 4:
Arrangement of the Data Deck for the VAFB Irregular Outline

```
Column          11111111
       12345678901234567

       IRREGULAR OUTLINE
            1   7  59
            1   7  57
            -   -   -              102 data cards
            -   -   -
            2  45  18
       99999
```

Once the irregular outline was determined and keypunched, it was used for all successive GRID maps. The irregular outline is not usually changed in a study area once it is set. If the irregular outline is changed, the data coded for the grid cells must be readjusted to fit in the new irregular outline.

5. MAP PACKAGE

This package instructs the computer on how to make the GRID map. A set of map electives are used to specify the instructions for making the map.

a. Preparation of the Package

The map package is prepared according to the following procedure:

(1) On the first card of the package, punch MAP in columns 1-3.
(2) On the last card of the package, punch 99999 in columns 1-5.
(3) On the second, third, and fourth cards, punch the title you wish to have appear below the map. One or more of these cards may be left blank, but all 3 cards must be included.
(4) On the cards to be inserted between the fourth and last card, the desired electives are punched. Whenever a map elective is not called for, the standard result described under each elective will automatically occur. Electives 1 and 7 must be included because there is no standard condition created by the program for them.

b. Standard Format for the Electives

A standard format is used for the electives with the exception of electives 7, 10, and 13. The format is:

(1) The elective number is punched as an integer in columns 4 and 5 (right justified).
(2) Six fields of 10 columns each are used for specifying the electives:

| Field | Columns |
|---|---|
| 1 | 11-20 |
| 2 | 21-30 |
| 3 | 31-40 |
| 4 | 41-50 |
| 5 | 51-60 |
| 6 | 61-70 |

The numbers punched in any of the six fields are real numbers and should contain a decimal point. The numbers may be punched anywhere within the columns assigned to that field. The decimal point may be omitted if the number is right justified.

c. Elective 1:
Grid (1 card)

The elective specifies the parameters for the rectangular grid that is to be mapped. In field 1 specify the number of rows of grid cells down the map. In field 2 specify the number of columns of grid cells across the map.

Fields 3 and 4 specify the size of each printed grid cell. Field 3 specifies the number of characters down and field 4 specifies the number of characters across. If fields 3 and 4 are left blank, the printer cell size will be 4 x 5 or ½ inch square.

For the VAFB irregular outline, a grid cell of 1 character (1 x 1) produces a map of approximately 8½ by 19½ inches when 8 characters per inch are printed by the line printer. This map is slightly distorted vertically since the line printer will print 10 characters per inch horizontally. The 1 x 1 map is suitable for most studies.

A larger map with slightly less distortion can be produced when the grid cell size is 2 x 3 (2 characters vertically by 3 characters horizontally). The line printer is set at 6 characters per inch vertically for this map. The map is produced in 2 parts by the GRID program. The halves must be taped together to form a complete map. The map measures approximately 22 by 49½ inches when measured from the bordering row and column numbers. The 2 x 3 grid cell map takes approximately twice as much computer time to produce as the 1 x 1 grid cell map. Example 5 shows how to punch Elective 1 for a 2 x 3 grid cell size for the VAFB irregular outline.

Example 5:
Elective 1

| Column | 5 | 11-20 | 21-30 | 31-40 | 41-50 |
|---|---|---|---|---|---|
| | 1 | 146.0 | 68.0 | 2.0 | 3.0 |

d. Elective 2:
Data (1 card)

This elective controls the input options for the data. Data Option A (see section on the data package) was used for the VAFB data base. To activate Data Option A, specify a number greater than zero in field 1. The number specified in field 1 is transferred to Subroutine Flexin as the value of IFORM. The use of IFORM is discussed in the section on Subroutine Flexin. Example 6 shows how Elective 2 was used for the Vandenberg study.

Example 6:
Elective 2

| Column | 5 | 20 |
|---|---|---|
| | 2 | 2 |

e. Elective 3:

Number of Levels (1 card)

This elective is used to specify the number of levels or class intervals used for the GRID map (from 2 to 10). The number desired is punched as a decimal number in field 1. Standard is 10 levels. Example 7 shows how to punch Elective 3 for an 8 level map.

Example 7:
Elective 3

| Column | 5 | 11-20 |
|---|---|---|
| | 3 | 8.0 |

f. Elective 4:

Value Range Minimum (1 card)

This elective is used to specify a number as the minimum value of the total value range of the data. The number is punched as a decimal number in field 1. Standard is to use the minimum value of the data.

g. Elective 5:

Value Range Maximum (1 card)

This elective is used to specify a number as the maximum value of the total value range of the data. The number is punched as a decimal number in field 1. Standard is to use the maximum value of the data.

h. Elective 6:

Value Range Intervals (1 to 2 cards)

This elective controls the value range for each level or interval. The total value range of the data, as modified by the minimum and maximum of the data, (Electives 4 and 5), will be divided up into the number of levels specified in Elective 3. Standard is to have each level or interval assigned an equal range.

To specify the desired range for each level, use values proportionate to the size of the desired ranges. These should be punched as decimal numbers. See Example 8. If there are more than 6 levels, continue on a second card, punching the number for the seventh level in field 1, for the eighth level in field 2, etc.

Example 8:
Unequal Value Range Levels

The data are to be divided in 4 levels: the lowest 10 percent, the next 25 percent, the next 35 percent, and the remainder. One card for Elective 6 would be punched as follows:

| Column | 5 | 11-20 | 21-30 | 31-40 | 41-50 |
|---|---|---|---|---|---|
| | 6 | 10. | 25. | 35. | 30. |

i. Elective 7:

Symbolism (5 cards)

This elective specifies the symbolism that will be printed on the map. No standard symbolism is stored in the program. Therefore, this

elective must be included in the map package. All 5 cards must be included each time the program is run.

On card 1, punch the elective number 7 in column 5.

On card 2, punch as follows (any print characters may be used for symbolism):

Columns 1-10 *are used to specify the general symbolism for each level* (column 1 for the symbol to designate the first level, etc. -- for as many levels as are to be used).

Columns 11-20 are used to specify the special symbolism for the flag points (column 11 for the symbol to designate flag points in the first level, etc.). The flag point is the central character of a grid cell.

Column 21 is used to specify the symbolism for a value less than the *minimum specified in Elective 4.*

Column 22 is used to specify the flag point symbolism for a low value.

Column 23 is used to specify the symbolism for a value greater than the maximum specified in Elective 5.

Column 24 is used to specify the flag point symbolism for a high value.

Column 25 is used to specify background symbolism. Background symbolism appears outside the outline of the study area. This column is normally left blank to indicate that no symbolism is to appear *outside of the study area.*

On cards 3, 4 and 5, punch in the columns given above any overprint desired. Any printer characters may be used. Example 9 shows a gray scale symbolism for 10 levels.

Example 9:
Gray Scale Symbolism for 10 levels

*This example shows:*

(1) A gray scale for 10 levels of symbolism (columns 1-10).
(2) Flag point symbolism for the 10 levels (columns 11-20).
(3) Blank low value symbolism and flag point (columns 21-22).
(4) Blank high value symbolism and flag point (columns 23-24).
(5) Blank background symbolism (column 25).

```
        Column       111111111122222222
            123456789012345678901234567
            ---------------------------
card 1          7
card 2      .,,+X00000Ø123456789
card 3        .-X0000A
card 4            -=XX
card 5               V
```

A 2 x 3 grid cell for level 7 would be printed on the GRID map as follows:

```
θθθ
θ7θ
```

To make a gray scale for less than 10 levels, the level symbols can be eliminated in the following order:

| | | | |
|---|---|---|---|
| for: | 9 levels | eliminate: | 2 |
| | 8 levels | | 2, 9 |
| | 7 levels | | 2, 9, 8 |
| | 6 levels | | 2, 9, 8, 3 |
| | 5 levels | | 2, 9, 8, 3, 6 |

The flag point symbolism should be adjusted accordingly.

j. Elective 8:
Flag Point (1 card)

The flag point is the central character of a grid cell. The flag point symbolism specified in Elective 7 is printed at the flag point. If flag point symbolism is not desired, specify 1.0 in field 1. Standard is special symbolism at the flag point. When a map is made with a 1 x 1 character grid, the flag point symbolism is automatically suppressed.

k. Elective 9:
Histogram (1 card)

This elective controls the printing at the bottom of the map. Specify 1.0 in field 1 to generate a histogram bar chart at the bottom of the map. This bar chart shows the frequency of grid cells in each level. Specify 1.0 in field 2 to suppress numeric information which is included with the levels. Standard is no bar chart and inclusion of numeric information.

l. Elective 10:
Text (3 to 32 cards)

This elective is used to print up to 30 lines of text below the map. Standard is to have no text. However, some explanatory text is usually desirable for interpreting the map.

To use this elective:

(1) On card 1, punch the identifying elective number 10 in columns 4-5.
(2) On not more than 30 other cards, to be inserted between the first and last, punch in columns 1-72 any supplementary information to be used as the text for the map.
(3) On the last card, punch ENDTEXT in columns 1-7.

m. Elective 13:
Grid Numbering (1 card)

This elective generates row and column numbers on all four sides of the grid map to assist the user in locating individual cells on the map.

The top left hand cell of the grid is called the Reference Grid Cell (RGC). It provides the coordinates from which all the rows and columns are numbered. If the coordinates of the RGC are not specified, the program assumes them to be:

Column = 1
Row = N (N is the number of rows specified in Elective 1)

In field 1 specify 1.0 for grid numbering. In field 2 specify the column number of the RGC. The standard for Elective 13 is no numbering. Example

10 shows the use of Elective 13 for the VAFB irregular outline.

Example 10:
Elective 13 for the VAFB irregular outline

| Column | 4-5 | 18-20 | 28-30 | 36-40 |
|---|---|---|---|---|
| | 13 | 1.0 | 1.0 | 147.0 |

When Elective 13 is specified using the numbers given in Example 10, the row numbers will correspond to the row numbers given in the C-1.2 series of maps in the Base Master Plan. The column designators have been changed to correspond to the alpha designators given in the C-1.2 series of maps in the Base Master Plan. Subroutine FLATON on the GRID program was modified to print the alpha designators when Elective 13 is specified. Therefore, when Elective 13 is used, the alphanumeric coordinates of a grid cell correspond to the grid system and registration described in Section VII.

Example 11:
An Example of a Map Package

Example 2 showed how to use Flexin to produce a map which displays areas of suitable habitat for the California Legelss Lizard (Anniella pulchra). This example shows how the map package is set up to produce the map. The following cards are used to set up the map package:

Card 1:

| Column | 1-3 |
|---|---|
| | MAP |

Card 2:

| Column | 2-63 |
|---|---|
| | ANNIELLA PULCHRA MICROHABITAT / DISTRIBUTION ON VANDENBERG AFB |

Card 3: Blank

Card 4: Blank

Card 5: Elective 1

| Column | 5 | 16-20 | 27-30 | 38-40 | 48-50 |
|---|---|---|---|---|---|
| | 1 | 146.0 | 68.0 | 1.0 | 1.0 |

Card 6: Elective 2

| Column | 5 | 20 |
|---|---|---|
| | 2 | 2 |

Card 7: Elective 4

| Column | 5 | 11-13 |
|---|---|---|
| | 4 | 0.5 |

Card 8: Elective 5

| Column | 5 | 11-14 |
|---|---|---|
| | 5 | 10.5 |

Card 9: Elective 6

| Column | 5 | 11-13 | 21-23 | 31-33 | 41-43 | 51-53 | 61-63 |
|---|---|---|---|---|---|---|---|
| | 6 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

Card 10: Continuation of Elective 6

| Column | 11-13 | 21-23 | 31-33 | 41-43 |
|---|---|---|---|---|
| | 1.0 | 1.0 | 1.0 | 1.0 |

Card 11: Elective 7

| Column | 5 |
|---|---|
| | 7 |

Card 12: Continuation of Elective 7

| Column | 1-20 |
|---|---|
| | ,,+X00000.123456789. |

Card 13: Continuation of Elective 7

| Column | 2-9 |
|---|---|
| | .-X0000A |

Card 14: Continuation of Elective 7

| Column | 6-9 |
|---|---|
| | -=XX |

Card 15: Continuation of Elective 7

| Column | 9 |
|---|---|
| | V |

Card 16: Elective 9

| Column | 5 | 18-20 |
|---|---|---|
| | 9 | 1.0 |

Card 17: Elective 10

| Column | 4-5 |
|---|---|
| | 10 |

Card 18: Continuation of Elective 10

Column 7-24
THE MAP LEGEND IS:

Card 19: Continuation of Elective 10

Column 7-23
LEVEL 1= COASTAL STRAND ( )

Card 20: Continuation of Elective 10

Column 7-60
LEVEL 2= COASTAL SAGE SCRUB-STABILIZED DUNE PHASE ( )

Card 21: Continuation of Elective 10

Column 7-33
LEVEL 3= COASTAL BLUFF ( )

Card 22: Continuation of Elective 10

Column 7-31
LEVEL 4= OAK WOODLAND ( )

Card 23: Continuation of Elective 10

Column 7-46
LEVEL 5= SUITABLE SOIL ASSOCIATIONS ( )

Card 24: Continuation of Elective 10

Column 7-58
LEVEL 6= COASTAL STRAND / SUITABLE SOIL OVERLAP ( )

Card 25: Continuation of Elective 10

Column 7-71
LEVEL 7= COASTAL SAGE SCRUB-STABILIZED DUNE PHASE / SUITABLE SOIL

Card 26: Continuation of Elective 10

Column 16-27
OVERLAP ( )

Card 27: Continuation of Elective 10

Column 7-57
LEVEL 8= COASTAL BLUFF / SUITABLE SOIL OVERLAP ( )

Card 28: Continuation of Elective 10

| Column | 7-56 |
|---|---|
| LEVEL 9= OAK WOODLAND / SUITABLE SOIL OVERLAP ( ) | |

Card 29: Continuation of Elective 10

| Column | 7-22 |
|---|---|
| | BACKGROUND= .... |

Card 30: ENDTEXT

| Column | 1-7 |
|---|---|
| | ENDTEXT |

Card 31: Elective 13

| Column | 4-5 | 18-20 | 28-30 | 36-40 |
|---|---|---|---|---|
| | 13 | 1.0 | 1.0 | 147.0 |

Card 32: Last Card of Map Package

| Column | 1-5 |
|---|---|
| | 99999 |

6. DATA INPUT PACKAGE

The GRID program has two input options for the data. These input options optimize the use of the program under two different types of operations.

a. Data Option A.

Option A uses GRID as an independent program in which Subroutine Flexin is used to:

(1) Read the data.
(2) Perform calculations on the data so as to generate the value to be mapped.

In Option A, the data are processed one cell at a time. This allows flexibility in the organization of the data. The Vandenberg data base is designed to operate using Option A.

Each time a map is made with GRID the basic data file must be read. The Vandenberg data file is available on either cards or magnetic tape. Since the data file is rather large (4646 cards), it is more efficient to submit the data file on magnetic tape. This permits the user to rewind the file between maps.

Data Option A is activated by specifying a number greater than zero in field 1 of Elective 2 (see Map Package). This number is transferred to Subroutine Flexin as the value of IFORM. IFORM is discussed in Section VI3.

b. Data Option B

This option was not used with the Vandenberg data base. In Option B, the data used to create the map are transferred to the GRID program as a series of binary arrays. One array specifies each row of the map. The program will expect one real value in the array for each cell in a row.

Option B is different from Option A in that it uses GRID as a final job step in a series of job steps to produce the map.

Option B is used automatically if Elective 2 is not specified. It is also used if zero is specified in field 1 of Elective 2.

7. COMPUTER SUBMISSIONS

After the packages have been prepared they must be placed in the correct order, together with the control cards needed for submission to the computer. The following procedure is used to operate the GRID program with the VAFB data base on the Burroughs 3500 computer.

a. To compile the GRID program and load to the program library use the following control cards:

(1) Column 1-37

```
1
2COMPILE SNFTØØ XFORTN LIB DATA CARDS
3
```

(2) Column 1-5

```
11
3 LST1
8
```

*GRID program (including Subroutine Flexin)*

(3) Column 1-4

```
1
2END
3
```

b. To execute the GRID program and produce the map use the following control cards:

(1) Column 1-21

```
1
2EX SNFTØØ DATA FILE5
3
```

Data on which the program operates

(2) Column 1-4

```
1
2END
3
```

c. Data on which the program operates:

The data on which the program operates (see above) consist of the Irregular Outline Package, the Map Package, and the Data Input. These packages must be in the correct order in the input card deck.

(1) The order for submitting the deck when the Data Input is read from cards is:

Control Card
Irregular Outline Package
Map Package(s)
Data Input
Control Card

The end of the Data Input is signaled by a card with END punched in columns 1-3. This card immediately follows the last data card.

The Irregular Outline Package must <u>precede</u> the Map Package to which it refers. Once the irregular outline has been specified it will be used for every Map Package in the computer submission.

Each time the program reads a Map Package it will attempt to make a map. There is no limit to the number of Map Packages in any one submission.

If the Data Input is read from cards, it must immediately follow the Map Package to which it refers.

(2) The order for submitting the deck when the Data Input is read from magnetic tape is:

Control Card
Irregular Outline Package
Map Package(s)
Control Card

The end of the Data Input is signaled by a card with END punched in columns 1-3 immediately following the last card in the Map Package. The READ statement in Subroutine Flexin must be changed to indicate that the data is being read from tape instead of cards.

8. SEARCH/COUNT PROGRAM

This program can be used in conjunction with GRID or independently as a feature of the EPS developed for VAFB. The Search/Count program will locate and print out data base variables for selected grid cells. By entering the alphanumeric coordinates of selected grid cells, the program will print out the data base variables for each grid cell, count the frequency of each subvariable, and convert the frequency to estimated acres. The Search/Count program is useful for studies such as computing the areas of various vegetation types that would be affected by alternate placements of a runway-launch complex.

The Search/Count program, like GRID, is written in FORTRAN IV and requires the user to have a basic knowledge of computer programming. A listing of the

Search/Count program, as used in a case study, is given in Appendix G. The user should refer to this listing as a guide in setting up the program.

Certain statements within the Search/Count program must be modified to fit the user's needs. These modifications are given in the following sections.

a. Title
A title identifying the particular use of the Search/Count program should be included at the beginning of the program using comment cards.

b. REAL*8 Statement
This statement must be modified to reflect the exact number of 23-acre grid cells to be counted in the program. To count 43 grid cells, the statement would be:

```
REAL*8 C(43), CX
```

c. Size of Counting Arrays
The size of arrays used in the counting program need to be adjusted for the number of cells counted. For counting up to 100 grid cells, the array sizes used for the program in Appendix G can be used.

d. Data Statement
This statement is used to enter the alphanumeric coordinates of the selected grid cells. The general form is:

```
DATA C/'xxxxx','xxxxx','xxxxx'/
```

Columns 7-72 are used for the Data Statement. Since only 7 grid cells can be entered on the first card, continuation cards are required. The general form for the alphanumeric coordinate of a grid cell is: 'xxxxx'.

## SECTION VII

## QUANTITATIVE ECOLOGICAL DATA BASE

### 1. GRID SYSTEM AND REGISTRATION

The grid system and registration used for the study of VAFB is based on the California Coordinate System. The basic units of this system are feet. The California Coordinate System was chosen for the Vandenberg study because of its flexibility. Most maps used in relation to the project were registered in California coordinate units. This greatly facilitated the transfer of information into the data base.

A basic grid cell size of 1000 by 1000 feet was adopted to register all information collected for the computerized data base. This represents a subdivision into 24 equal parts of the standard 4000 by 6000-foot sections of the California Coordinate System. The problem in determining grid cell size is that it should not be too small to be unfeasible for storage and economy and it should be small enough for the required analysis purposes. The 1000-foot grid cell has been used effectively in previous land use studies (Reference 3). It was determined to be suitable for this study only after thorough evaluation and discussion of the scope of the project.

The 1000-foot grid cell encompasses an area of approximately 23 acres. There are 4646 of the 1000-foot grid cells enclosing the approximate boundaries of VAFB. If a smaller grid cell size is required for registering data, the 1000-foot cell can be subdivided into nine 2.55-acre grid cells measuring 333.33 feet on each side (see Figure 7). For example, sensitive areas that need more detailed analysis could be redefined from the larger 23-acre units into the smaller 2.55-acre units.

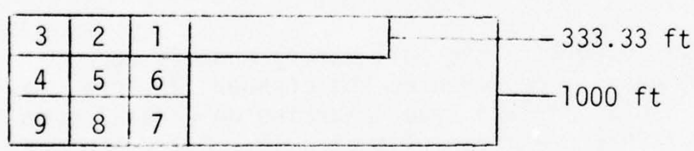



Figure 7. Grid Cell Scales

An alphanumeric registration system was adopted to locate a particular grid cell in the Vandenberg area. Each 1000-foot vertical line is coded with a two-letter designator. The 1000-foot horizontal lines are coded with number designators. See C-1.2 series of maps in the Base Master Plan (Reference 4). A series of letters and numbers will then specify a particular grid cell in the Vandenberg area. The cell is identified by a point in the southwest corner of the grid cell. For example, RA055 represents the cell where the vertical line RA intersects the horizontal line 055. Figure 8 illustrates this.

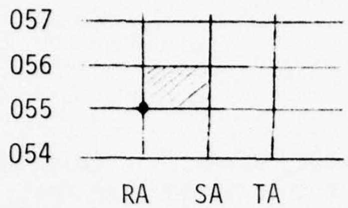



Figure 8. Grid Cell Coordinates

If the coordinate of the grid cell specified in Figure 7 is RA055, the coordinate of the fourth subcell is specified as RA055.4.

## 2. SOIL DATA BASE

The U.S. Department of Agriculture soil surveys of Northern Santa Barbara area and Santa Barbara area (References 9, 10) were used to classify the soils occurring within VAFB. The soils were classified and coded according to:

a. soil series and phase or
b. land type
c. slope of the land

Soils with similar profiles make up a soil series. A soil series is divided into phases based on the texture of the surface soil and slope. A land type is soil material that cannot be classified into a soil series because it is too rocky, shallow, or severely eroded. A land type is given a descriptive name in contrast to a soil series which is named for the town or geographic feature near the place where the soil of that series was first observed and mapped.

A transparent grid overlay was used with the soil survey maps to code the soils. Each grid cell on the overlay represented the standard 23-acre grid cell. The predominant soil series or land type occurring on each 23-acre grid cell was used for the overall interpretation of that cell. Forty-three different soil series and 13 land types were classified on VAFB using this coding method.

The combination of the soil series/phase or land type with the slope characteristic can be used to determine the erosion potential on the soil. Similarly, it can be used to predict the potential occurrence of a plant or animal according to its substrate preference. One hundred eighty-three different soil/slope categories were coded on VAFB using the above system. Table 17 lists the soil/slope categories in the data base.

The soil/slope type for each grid cell was coded on computer data cards in integer form using the code numbers listed in Table 17. Twenty-five fields of three columns each were defined in columns 1-75 of each data card. Columns 76-80 were assigned an identification number for ordering purposes. Therefore, the soil/slope types for 25 grid cells were coded on each computer data card.

TABLE 17. SOIL/SLOPE CODES AND CATEGORIES FOR VANDENBERG AFB

| Code Number | Symbol | Name |
|---|---|---|
| 0 | -- | Ocean |
| 2 | AgC | Agueda silty clay loam, 0 to 2% slopes |
| 4 | ArD | Arnold sand, 5 to 15% slopes |
| 5 | ArF | Arnold sand, 15 to 45% slopes |
| 6 | ArF3 | Arnold sand, 9 to 45% slopes, severely eroded |
| 16 | Bd | Bayshore loam, drained |
| 18 | Bg | Bayshore silty clay loam |
| 23 | BnB2 | Betteravia loamy sand, dark variant, 0 to 5% slopes, eroded |
| 24 | BnD2 | Betteravia loamy sand, dark variant, 5 to 15% slopes, eroded |
| 25 | BoA | Botella loam, 0 to 2% slopes |
| 27 | BoC | Botella loam, 2 to 9% slopes |
| 28 | BoD2 | Botella loam, 2 to 15% slopes, eroded |
| 29 | BsA | Botella loam, slightly wet, 0 to 2% slopes |
| 30 | BtA | Botella clay loam, 0 to 2% slopes |
| 31 | BtA2 | Botella clay loam, 0 to 2% slopes, eroded |
| 32 | BtC | Botella clay loam, 2 to 9% slopes |
| 33 | BtD2 | Botella clay loam, 2 to 15% slopes, eroded |
| 34 | BwA | Botella clay loam, wet, 0 to 2% slopes |
| 35 | Ca | Camarillo sandy loam |
| 37 | Cc | Camarillo very fine sandy loam |
| 38 | Cd | Camarillo silty clay loam |
| 43 | ChD | Chamise shaly loam, 9 to 15% slopes |
| 44 | ChF | Chamise shaly loam, 15 to 45% slopes |
| 46 | ChG2 | Chamise shaly loam, 30 to 75% slopes, eroded |
| 48 | CmF | Climara-Toomes complex, 15 to 45% slopes |
| 49 | CnB | Coastal beaches |
| 52 | CrF | Contra-Costa-Lodo loams, 30 to 45% slopes |
| 55 | CtA | Corralitos sand, 0 to 2% slopes |
| 56 | CtD | Corralitos sand, 2 to 15% slopes |
| 57 | CtD2 | Corralitos sand, 9 to 15% slopes, eroded |
| 58 | CuA | Corralitos loamy sand, 0 to 2% slopes |
| 59 | CuC | Corralitos loamy sand, 2 to 9% slopes |
| 60 | CuD | Corralitos loamy sand, 9 to 15% slopes |
| 62 | CwE | Crow Hill loam, 15 to 30% slopes |
| 63 | CwF | Crow Hill loam, 30 to 45% slopes |
| 64 | CwG | Crow Hill loam, 45 to 75% slopes |
| 65 | CwG3 | Crow Hill loam, 15 to 75% slopes, severely eroded |
| 66 | DaD | Diablo silty clay, 9 to 15% slopes |
| 67 | DaE | Diablo silty clay, 15 to 30% slopes |
| 68 | DaF | Diablo silty clay, 30 to 45% slopes |
| 71 | DuE | Dune land |
| 74 | EdA2 | Elder sandy loam, 0 to 2% slopes, eroded |
| 75 | EdC2 | Elder sandy loam, 2 to 9% slopes, eroded |
| 76 | EdD2 | Elder sandy loam, 9 to 15% slopes, eroded |
| 78 | EmC | Elder loam, 2 to 9% slopes |
| 79 | EnA2 | Elder shaly loam, 0 to 2% slopes, eroded |
| 80 | EnC2 | Elder shaly loam, 2 to 9% slopes, eroded |

TABLE 17. SOIL/SLOPE CODES AND CATEGORIES FOR VANDENBERG AFB (Continued)

| Code Number | Symbol | Name |
|---|---|---|
| 81 | EnD2 | Elder shaly loam, 9 to 15% slopes, eroded |
| 89 | GmG | Gaviota sandy loam, 30 to 75% slopes |
| 91 | GsE | Gazos clay loam, 15 to 30% slopes |
| 92 | GsF | Gazos clay loam, 30 to 45% slopes |
| 93 | GsG | Gazos clay loam, 45 to 75% slopes |
| 94 | GuE | Gullied land |
| 99 | LaF | Landslides |
| 101 | LcE | Linne clay loam, 15 to 30% slopes |
| 102 | LcF | Linne clay loam, 30 to 45% slopes |
| 103 | LcG | Linne clay loam, 45 to 75% slopes |
| 106 | LmG | Lopez shaly clay loam, 15 to 75% slopes |
| 107 | LoE | Los Osos clay loam, 15 to 30% slopes |
| 108 | LoG | Los Osos clay loam, 30 to 75% slopes |
| 109 | LsE | Los Osos-San Benito clay loams, 15 to 30% slopes |
| 110 | LsF | Los Osos-San Benito clay loams, 30 to 45% slopes |
| 112 | MaA | Marina sand, 0 to 2% slopes |
| 113 | MaC | Marina sand, 2 to 9% slopes |
| 114 | MaE | Marina sand, 9 to 30% slopes |
| 115 | MaE3 | Marina sand, 9 to 30% slopes, severely eroded |
| 116 | Mh | Marsh |
| 118 | MnA | Metz loamy sand, 0 to 2% slopes |
| 119 | MnC | Metz loamy sand, 2 to 9% slopes |
| 123 | Mr | Mocho sandy loam, overflow |
| 126 | Mu | Mocho fine sandy loam |
| 127 | Mv | Mocho loam |
| 129 | Mx | Mocho silty clay loam |
| 130 | MyG | Montara rocky clay loam, 30 to 75% slopes |
| 131 | NrB | Narlon sand, 0 to 5% slopes |
| 132 | NsA | Narlon loamy sand, 0 to 2% slopes |
| 133 | NsC | Narlon loamy sand, 2 to 9% slopes |
| 134 | NsD | Narlon loamy sand, 9 to 15% slopes |
| 136 | NvC | Narlon sand, hardpan variant, 2 to 9% slopes |
| 137 | OcA | Oceano sand, 0 to 2% slopes |
| 138 | OcD | Oceano sand, 2 to 15% slopes |
| 159 | Rs | Riverwash |
| 160 | RuG | Rough broken land |
| 161 | SaA | Salinas loam, 0 to 2% slopes |
| 162 | SaC | Salinas loam, 2 to 9% slopes |
| 166 | SeD | Salinas and Sorrento loams, 9 to 15% slopes |
| 167 | SfD | San Andreas-Tierra complex, 5 to 15% slopes |
| 168 | SfE | San Andreas-Tierra complex, 15 to 30% slopes |
| 169 | SfF3 | San Andreas-Tierra complex, 9 to 45% slopes, severely eroded |
| 170 | SfG | San Andreas-Tierra complex, 30 to 75% slopes |
| 172 | SgG | San Benito-Diablo complex, 45 to 75% slopes |
| 173 | Sh | Sandy alluvial land |
| 174 | Sk | Sandy alluvial land, wet |
| 175 | SmD | Santa Lucia shaly clay loam, 9 to 15% slopes |
| 176 | SmE | Santa Lucia shaly clay loam, 15 to 30% slopes |

TABLE 17. SOIL/SLOPE CODES AND CATEGORIES FOR VANDENBERG AFB (Continued)

| Code Number | Symbol | Name |
|---|---|---|
| 177 | SmF | Santa Lucia shaly clay loam, 30 to 45% slopes |
| 179 | SmG | Santa Lucia shaly clay loam, 45 to 75% slopes |
| 184 | SpG | Sedimentary rock land |
| 185 | SrE | Shedd silty clay loam, 15 to 30% slopes |
| 186 | SrF | Shedd silty clay loam, 30 to 45% slopes |
| 187 | SrG | Shedd silty clay loam, 45 to 75% slopes |
| 188 | SrG3 | Shedd silty clay loam, 30 to 75% slopes, severely eroded |
| 190 | SsF | Shedd silty clay loam, diatomaceous variant, 30 to 45% slopes |
| 196 | SvC | Sorrento loam, 2 to 9% slopes |
| 204 | Szw | Swamp |
| 205 | TaA | Tangair sand, 0 to 2% slopes |
| 206 | TaC | Tangair sand, 2 to 9% slopes |
| 207 | TcG | Terrace escarpments, sandy |
| 208 | TdF | Terrace escarpments, loamy |
| 211 | TmE | Tierra loamy sand, 9 to 30% slopes |
| 212 | TnC | Tierra sandy loam, 2 to 9% slopes |
| 213 | TnD2 | Tierra sandy loam, 9 to 15% slopes, eroded |
| 214 | TnE2 | Tierra sandy loam, 15 to 30% slopes, eroded |
| 215 | TrC | Tierra loam, 2 to 9% slopes |
| 216 | TrD | Tierra loam, 9 to 15% slopes |
| 217 | TrE2 | Tierra loam, 15 to 30% slopes, eroded |
| 218 | TrE3 | Tierra loam, 5 to 30% slopes, severely eroded |
| 219 | TsF | Tierra clay loam, 15 to 45% slopes |
| 220 | TxG | Toomes-Climara complex, 30 to 75% slopes |
| 226 | Td | Tangair sand, 16 to 30% slopes |
| 227 | Th | Tangair sand, 9 to 15% slopes, severely eroded |
| 228 | Tf | Tangair sand, 9 to 15% slopes |
| 229 | Su | Santa Lucia, stony soils, undifferentiated, 31%+ slopes |
| 230 | Lp | Los Osos, stony soils, undifferentiated, 31%+ slopes |
| 231 | Te | Tangair sand, 16 to 30% slopes, moderately eroded |
| 232 | Ta | Tangair loamy sand, 16 to 30% slopes |
| 233 | Tb | Tangair loamy sand, 9 to 15% slopes |
| 234 | Tc | Tangair loamy sand, 9 to 15% slopes, moderately eroded |
| 235 | At | Arguello shaly loam, 9 to 15% slopes |
| 236 | Bl | Baywood loamy sand, gently sloping, 3 to 8% slopes |
| 237 | Bn | Baywood loamy sand, over Watsonville soils, gently sloping, 3 to 8% slopes |
| 238 | Sq | Santa Lucia shaly loam, 16 to 30% slopes |
| 239 | Sr | Santa Lucia shaly loam, 31 to 45% slopes |
| 240 | Lr | Los Trancos stony loam, 16 to 45% slopes |
| 241 | Lf | Los Osos clay, 31 to 45% slopes |
| 242 | Yd | Yolo loam, 9 to 15% slopes |
| 243 | Le | Los Osos clay, 16 to 30% slopes |
| 244 | Ja | Jalama shaly sandy loam, 3 to 15% slopes |
| 245 | Wh | Watsonville loam, 3 to 8% slopes |
| 246 | As | Arguello shaly loam, 3 to 8% slopes |
| 247 | Bp | Baywood loamy sand, 9 to 15% slopes |
| 248 | Ec | Elder shaly clay loam, 3 to 8% slopes |

TABLE 17. SOIL/SLOPE CODES AND CATEGORIES FOR VANDENBERG AFB (Continued)

| Code Number | Symbol | Name |
|---|---|---|
| 249 | St | Santa Lucia stony clay loam, 16 to 30% slopes |
| 250 | Bk | Baywood loamy fine sand, over Watsonville soils, 3 to 8% slopes |
| 251 | Ss | Santa Lucia shaly loam, 46%+ slopes |
| 252 | Nd | Nacimiento clay, 31 to 45% slopes |
| 253 | Cn | Climax clay (adobe), 31 to 45% slopes |
| 254 | Cm | Climax clay (adobe), 16 to 30% slopes |
| 255 | Gk | Gaviota stony soils, undifferentiated, 31%+ slopes |
| 256 | Ne | Nacimiento clay, 31 to 45% slopes, moderately eroded |
| 257 | Rh | Rough gullied land, Los Osos soil material |
| 258 | Yg | Yolo loam, 0 to 2% slopes |
| 259 | Ye | Yolo loam, 3 to 8% slopes |
| 260 | Na | Nacimiento clay, 16 to 30% slopes |
| 261 | Ct | Crow Hill loam, 9 to 15% slopes |
| 263 | Sa | San Andreas fine sandy loam, moderately eroded, 9 to 15% slopes |
| 264 | Tp | Tierra fine sandy loam, moderately eroded, 31 to 45% slopes |
| 265 | (Sh) | San Andreas stony soils, undifferentiated, 46%+ slopes |
| 267 | Zv | Zaca stony soils, undifferentiated, 31%+ slopes |
| 270 | Zm | Zaca shaly clay loam, 16 to 30% slopes |
| 271 | Zk | Zaca shaly clay loam, 31 to 45% slopes |
| 272 | Zg | Zaca shaly clay loam, 16 to 30% slopes |
| 273 | Za | Zaca clay, 16 to 30% slopes |
| 274 | Jc | Jalama stony soils, undifferentiated, 16 to 45% slopes |
| 275 | Jb | Jalama shaly, sandy loam, 16 to 30% slopes |
| 276 | Zs | Zaca, shaly clay loam, 31 to 45% slopes |
| 277 | Kb | Kitchen middens, over impermeable soil material |
| 278 | Zc | Zaca clay, 9 to 15% slopes |
| 279 | Zd | Zaca clay, 31 to 45% slopes |
| 280 | Nl | Nacimiento stony soils, undifferentiated, 46%+ slopes |
| 281 | S | San Andreas fine sandy loam, 16 to 30% slopes |
| 282 | Ad | Agueda, gravelly clay loam, 3 to 8% slopes |
| 283 | Ae | Agueda, gravelly clay loam, 9 to 15% slopes |
| 284 | MN | Montezuma clay (adobe), 3 to 8% slopes |
| 285 | Nf | Nacimiento clay, 46%+ slopes |
| 286 | Zp | Zaca shaly clay loam, 9 to 15% slopes |
| 287 | Ac | Agueda clay loam, 9 to 15% slopes |
| 288 | Zn | Zaca shaly clay loam, moderately eroded, 16 to 30% slopes |
| 289 | Zl | Zaca nonstony soils, undifferentiated, 46%+ slopes |
| 290 | Wn | Watsonville loam, 9 to 15% slopes |
| 291 | MV | Montezuma clay loam, 3 to 8% slopes |
| 292 | Tg | Tangair sand, moderately eroded, 9 to 15% slopes |

3. EXPOSURE DATA BASE

The exposure or aspect of the land was coded for each 23-acre grid cell. A transparent grid overlay was used with the C series of maps in the Base Master Plan (Reference 4) to code the exposure cell by cell. If multiple exposures occurred within a grid cell, the predominant exposure was used to describe the whole cell. Each cell was assigned an integer exposure code for processing exposure into the data base for the GRID computer program.

A series of 25 different exposure codes were used to evaluate the terrain. Codes 1-9 were used if a cell contained only a predominant single exposure (example: south facing). Codes 10-17 were used for multiple exposures in a cell caused by drainage areas. For example, a north sloping drainage provides both east and west exposure. Codes 18-25 were used for multiple exposures in a cell caused by a ridge line. For example, a ridge sloping to the northeast has northwest and southeast exposure. Table 18 lists the codes and categories used for describing exposure.

The exposure data were coded on computer data cards in two-column fields. Thirty-seven fields of two columns each were defined in columns 1-74. Columns 75-80 were assigned a card identification number. Using this coding system, 37 grid cells were contained on each data card.

4. ELEVATION DATA BASE

The elevation of the land was coded for each grid cell. Elevation was coded using the same basic procedure described for coding exposure. The highest elevation in a grid cell determined the overall elevation assigned to that cell. Elevation was coded in 200-foot intervals. Using this system, 10 different codes describe the elevation from sea level to the highest point on VAFB. All areas 1800 feet and above were combined into one elevation class. Table 19 lists the elevation codes and categories used in making the data base.

The elevation data were coded on computer data cards in one-column fields. Seventy-five fields of one-column each were defined in columns 1-75. Columns 76-80 were assigned a card identification number.

The exposure and elevation data can be used for a variety of purposes. Examples include: hydrologic studies, meteorological studies, and studies such as potential effects of exhaust clouds from rocket launches on land areas below the inversion layer.

5. VEGETATION DATA BASE

The vegetation data base was developed from the vegetation maps prepared for VAFB. The maps are transparent overlays to the Base Master Plan, map series C-1 (66 sheets, 1 inch:800 feet scale). After the maps were drawn the vegetation was coded for the computerized data base. A transparent grid overlay was used with the vegetation maps to code the data. The vegetation data were coded at the 2.55-acre subcell level. Each 23-acre grid cell was divided into nine subcells using a transparent grid overlay (see Figure 7).

The dominant type of vegetation of each of the subcells was coded onto data forms. In many cases, the determination of the dominant type was a complicated matter because the scale of the maps was such that one 2.55-acre cell could contain several different vegetation types. If one vegetation type

TABLE 18. EXPOSURE CODES AND CATEGORIES FOR VANDENBERG AFB.

| Code Number | Exposure |
|---|---|
| 1 | Undefinable direction, less than 10 degrees of slope |
| 2 | North |
| 3 | Northwest |
| 4 | West |
| 5 | Southwest |
| 6 | South |
| 7 | Southeast |
| 8 | East |
| 9 | Northeast |

Codes 10-17 describe multiple exposures in a cell due to drainage areas.

| Code Number | Exposure | Drainage |
|---|---|---|
| 10 | East and West | North |
| 11 | East and West | South |
| 12 | Northwest and Southeast | Northeast |
| 13 | Northwest and Southeast | Southwest |
| 14 | North and South | East |
| 15 | North and South | West |
| 16 | Northeast and Southwest | Northwest |
| 17 | Northeast and Southwest | Southeast |

Codes 18-25 describe multiple exposures in a cell due to ridge lines.

| Code Number | Exposure | Ridge |
|---|---|---|
| 18 | East and West | North |
| 19 | East and West | South |
| 20 | Northwest and Southeast | Northeast |
| 21 | Northwest and Southeast | Southwest |
| 22 | North and South | East |
| 23 | North and South | West |
| 24 | Northeast and Southwest | Northwest |
| 25 | Northeast and Southwest | Southeast |

TABLE 19. ELEVATION CODES AND CATEGORIES FOR VANDENBERG AFB.

| Code Number | Elevation (Feet) |
|---|---|
| 0 | 0 - 200 |
| 1 | 200 - 400 |
| 2 | 400 - 600 |
| 3 | 600 - 800 |
| 4 | 800 - 1000 |
| 5 | 1000 - 1200 |
| 6 | 1200 - 1400 |
| 7 | 1400 - 1600 |
| 8 | 1600 - 1800 |
| 9 | 1800 and above |

clearly covered the subcell, it was designated as the type for the entire subcell. If one vegetation type was not dominant in area within the subcell, relations of vegetation types to other types within and outside the subcell were taken into account.

The vegetation types were given an integer code for processing into the data base. Table 20 lists the codes and categories.

One computer data card was used for each grid cell of the vegetation data base. Table 21 lists the fields and columns used for each data card. The field used for describing optional information for each subcell was used to code subcells containing fire breaks. The code number 1 in the optional field indicates a fire break occurs in that subcell. Columns 45-68 on each grid cell data card are blank and can be used to code additional information about each grid cell.

The GRID program processes the vegetation data for a GRID map on a 23-acre cell size. Therefore, Subroutine Flexin must be modified to assign an overall vegetation type to a grid cell on the basis of the vegetation types assigned to the 9 subcells. Examples 12 and 13 show two different modifications of Flexin for assigning an overall vegetation type to a grid cell. Other modifications of Flexin are possible depending upon the user's needs and knowledge of FORTRAN.

Example 12:
Assigning Vegetation Type by the Center Subcell

The FORTRAN statements given in this example of Subroutine Flexin direct the computer to assign an overall vegetation type to a grid cell based on the vegetation type of the center subcell (subcell 5). It can be demonstrated statistically that this method will give an unbiased estimate of vegetation coverage for all the grid cells. The FORTRAN statements are:

```
                                                  Explanatory Notes:
      SUBROUTINE FLEXIN(IFORM, T, FIRST)
      READ(11, 11) V
   11 FORMAT(36X,F2.0)                                   a.
      T=5.                                               b.
      IF(V.EQ.12.) T=1.
      IF(V.EQ.8.) T=2.
      IF(V.EQ.11.) T=3.
      IF(V.EQ.3.) T=4.
      IF(V.EQ.31.) T=4.
      RETURN
      END
```

Explanatory Notes for Example 12:

a. This FORMAT statement and the READ statement direct the computer to read the vegetation type for subcell 5.
b. The remainder of the FORTRAN statements in the subroutine direct the computer to produce a vegetation map of 5 levels, based on the instructions given in the Map Package. In this case the Map Package would be set up to produce a GRID map showing 4 types of vegetation and the remainder as background.

TABLE 20. VEGETATION CODES AND CATEGORIES FOR VANDENBERG AFB.

| Code Number | Category |
|---|---|
| 1 | Bishop pine forest |
| 72 | Bishop pine forest - sparse phase |
| 2 | Tanbark oak forest |
| 3 | Foothill woodland |
| 31 | Foothill woodland - dense phase |
| 4 | Riparian woodland |
| 42 | Riparian woodland - sparse phase |
| 5 | Chaparral |
| 52 | Chaparral - sparse phase |
| 6 | Coastal sage scrub - normal phase |
| 62 | Coastal sage scrub - sparse phase |
| 7 | Coastal sage scrub - *Salvia leucophylla* phase |
| 8 | Coastal sage scrub - stabilized dune phase |
| 9 | Wet soil scrub |
| 10 | Huckleberry scrub |
| 11 | Coastal bluff |
| 12 | Coastal strand |
| 13 | Coastal salt marsh |
| 14 | Freshwater marsh |
| 16 | Grassland - annual |
| 17 | Miscellaneous native herb communities |
| 18 | Ruderal vegetation |
| 19 | Planted trees |
| 20 | Agricultural plantings |
| 21 | Non-agricultural plantings |
| 22 | Freshwater |
| 23 | Man-made facilities and cantonement |
| 24 | Disked areas |
| 25 | Naturally bare soil |
| 26 | *Acer negundo* stands |
| 99 | Land not within the base boundary |
| 00 | Ocean |

TABLE 21. VEGETATION DATA CARD FIELDS.

| Column | Field |
|---|---|
| 2-6 | Alphanumeric coordinates for the grid cell |
| 10-11 | Subcell 1 vegetation code |
| 12 | Subcell 1 optional field |
| 14-15 | Subcell 2 vegetation code |
| 16 | Subcell 2 optional field |
| 18-19 | Subcell 3 vegetation code |
| 20 | Subcell 3 optional field |
| 22-23 | Subcell 4 vegetation code |
| 24 | Subcell 4 optional field |
| 26-27 | Subcell 5 vegetation code |
| 28 | Subcell 5 optional field |
| 30-31 | Subcell 6 vegetation code |
| 32 | Subcell 6 optional field |
| 34-35 | Subcell 7 vegetation code |
| 36 | Subcell 7 optional field |
| 38-39 | Subcell 8 vegetation code |
| 40 | Subcell 8 optional field |
| 42-43 | Subcell 9 vegetation code |
| 44 | Subcell 9 optional field |
| 69-72 | Date the card was prepared |
| 77-80 | Identification number for each data card |

The mapping levels are:

Level 1 = Coastal strand
Level 2 = Coastal sage scrub-stabilized dune phase
Level 3 = Coastal bluff
Level 4 = Oak woodland
Level 5 = Background symbolism (all other vegetation types)

Example 13:
Assigning Vegetation Type by the Majority of Subcells

The FORTRAN statements given in this example of Subroutine Flexin direct the computer to assign an overall vegetation type to a grid cell based on the vegetation types of the majority of subcells. The FORTRAN statements are:

Explanatory Notes:

```
      SUBROUTINE FLEXIN( IFORM, T, FIRST)
     REAL A(9), B(9)
     DO 100 I=1,9
100  B(I)=0.
     READ(11,11) (A(I),I=1,9)
 11  FORMAT( 18X,9(2X,F2.0),26X)
     DO 200 IN=1,9
     DO 300 I=IN,9
300  IF(A(IN).EQ.A(I)) B(IN)=B(IN)+1
200  CONTINUE
     T=A(1)
     DO 400 I=1,8
400  IF(B(I).LT.B(I+1)) T=A(I+1)                                a.
     IF(T.EQ.3.) GO TO 590                                      b.
     IF(T.EQ.31.) GO TO 590
     IF(T.EQ.1.) T=5.
     IF(T.EQ.5.) GO TO 600
     IF(T.EQ.12.) T=1.
     IF(T.EQ.1.) GO TO 600
     IF(T.EQ.2.) T=5.
     IF(T.EQ.5.) GO TO 600
     IF(T.EQ.8.) T=2.
     IF(T.EQ.2.) GO TO 600
     IF(T.EQ.11.) T=3.
     IF(T.EQ.3.) GO TO 600
     T=5.
     IF(T.EQ.5.) GO TO 600
590  T=4.
600  CONTINUE
     RETURN
     END
```

Explanatory Notes for Example 13:

a. The value of T is the vegetation type of the majority of subcells.
b. The remainder of the FORTRAN statements direct the computer to produce a vegetation map of 5 levels, based on the instructions provided to the Map Package. The mapping levels are:

Level 1 = Coastal strand
Level 2 = Coastal sage scrub-stabilized dune phase
Level 3 = Coastal bluff
Level 4 = Oak woodland
Level 5 = Background symbolism (all other vegetation types)

Examples of different uses for the vegetation data base include:

a. Mapping and calculating areas sensitive to erosion due to unstable vegetation.
b. Predicting occurrences of rare, endangered, or depleted species of plants and animals based on their vegetation preferences.
c. Mapping and calculating areas of different vegetation types that would be affected by alternative placements of construction (runways, launch pads, etc.).

6. MERGED DATA BASE

In order to do analyses with GRID using more than one variable, a merged data base was produced. The data base variables for each grid cell were merged, resulting in a common data set. The merged data base is similar to the vegetation data base in that one computer data card is used to describe the data variables for each grid cell. Therefore, the merged data base contains 4646 data cards.

Table 22 lists the fields and columns describing a grid cell for each data card. The merged data base is available for GRID and other computer programs on either data cards or magentic tape at VAFB.

7. UPDATE PROCEDURES

The merged data base, because of its design, can easily be updated on a cell by cell basis. Example 14 illustrates the procedure for updating data cards.

Example 14:
Update Procedures for Data Cards

New firebreaks were made in a number of areas on the base. It is desireable to update the data base to include the new firebreaks. The following procedure can be used:

a. Locate the new firebreaks on the Base Master Plan Maps (C-1.2 series).
b. Identify the coordinates of the grid cells containing the new fire breaks -- for example, OA100, PA100, and QA100.
c. Locate the data cards in the data set which display the coordinates.
d. Keypunch new data cards to replace and update the affected data cards.
e. Return the updated data cards to their proper location in the data deck.

Data values can be updated on the magnetic tape by having the computer search the data tape for the desired cell coordinates and writing the new data values into their proper location on the tape. Example 15 illustrates the procedure with a FORTRAN program to update firebreaks in subcell 5 for the grid cells OA100, PA100, and QA100.

TABLE 22. MERGED DATA DECK FIELDS.

| Column | Field Description |
|---|---|
| 2-3 | S= |
| 4-6 | Soil/slope code |
| 8-10 | EX= |
| 11-12 | Exposure code |
| 14-16 | EL= |
| 17 | Elevation code |
| 19-20 | V= |
| 21-22 | Subcell 1 vegetation code |
| 23 | Subcell 1 optional field |
| 25-26 | Subcell 2 vegetation code |
| 27 | Subcell 2 optional field |
| 29-30 | Subcell 3 vegetation code |
| 31 | Subcell 3 optional field |
| 33-34 | Subcell 4 vegetation code |
| 35 | Subcell 4 optional field |
| 37-38 | Subcell 5 vegetation code |
| 39 | Subcell 5 optional field |
| 41-42 | Subcell 6 vegetation code |
| 43 | Subcell 6 optional field |
| 45-46 | Subcell 7 vegetation code |
| 47 | Subcell 7 optional field |
| 49-50 | Subcell 8 vegetation code |
| 51 | Subcell 8 optional field |
| 53-54 | Subcell 9 vegetation code |
| 55 | Subcell 9 optional field |
| 66-69 | Date the card was prepared |
| 71-75 | Alphanumeric coordinates for the grid cell |
| 77-80 | Identification number for the data card |

Example 15:
A FORTRAN Program to Update the Data Tape for Firebreaks

```
 1
 2COMPILE SNFT10 XFORTN LIB DATA CARDS
 3
11
 3LST1
 8
 IDENT MAIN
 FILE  11=ANFTOT,UNIT=TAPE,RECORD=80,BLOCKING=1,UNLABELED,FIXED
 C    UPDATE PROGRAM
       INTEGER V, ID
       REAL*8 C(3), CX
       V=1
       NTYPE = 3
       DATA C/'OA100', 'PA100', 'QA100'/
     1 READ(11,2) CX, ID
     2 FORMAT(70X,A5, 1X,I4)
       DO 3 J=1,NTYPE
       IF(CX.EQ.C(J)) GO TO 4
     3 CONTINUE
       IF(ID.LT.4646) GO TO 1
     4 WRITE(4,5) V
     5 FORMAT(38X, I1)
       IF(ID.LT.4646) GO TO 1
       END
 1
 2END
 3
```

APPENDIX A

GRID PROGRAM LISTING AS ADAPTED

TO THE BURROUGHS 3500 COMPUTER

```
IDENT MAIN
FILE   11=ANFTOT,UNIT=TAPE,RECORD=30,BLOCKING=1,LABELED,FIXED
LARGE C, A, B, LIM
SEGMENT MAPIN,INDATA,FLATON,HHEAD,FLEXIN
C          G   R   I   D       P   R   O   G   R   A   M              GRD00010
C        GRID MAP PROGRAM VERSION 3                                   GRD00020
C                                                                     GRD00030
C        PREPARED BY DAVID F. SINTON                                  GRD00040
C                                                                     GRD00050
C        LABORATORY FOR COMPUTER GRAPHICS                             GRD00060
C        HARVARD UNIVERSITY                                           GRD00070
C        AUGUST  1969                                                 GRD00080
C                                                                     GRD00090
C                                                                     GRD00100
C   MODIFIED BY TOM HARTSOOK   GEOG. DEPT.  SAN DIEGO STATE UNIV.   DCGRD00110
C                                                                     GRD00120
C   THIS VERSION OF GRID IS MODIFIED TO RUN ON  IBM 360/40 (DOS).   IT GRD00130
C   ACCEPT 10,000 DATA CELLS WITHOUT USING THE MULTIPLE DATA SET OPTION.GRD00140
C                                                                     GRD00150
C     MODIFIED FOR VANDENBERG AFB STUDY OCTOBER,1974 F.STUTZ,R.REILLY GRD00160
C                                                                     GRD00170
      COMMON/C/ F(10000)                                              GRD00180
      COMMON/A/ NCD,NCA,NGD,NGA,NSHEET,NCS,NCF,NCL,NUMCH,NCST,NRST    GRD00190
      COMMON/B/ NLEVEL,IFORM,NOD,IHIST,NTX,OPT(25)                    GRD00200
      COMMON/LIM/ VALMAX,VALMIN,RANGE(20),VAL(21),PRANGE(20),NFREQ(25) GRD00210
      COMMON /SYMBLS/ SYMBOL(25,4),NS(10),TITLE(60),TEXT(800)         GRD00220
      INTEGER SYMBOL                                                  GRD00221
      DIMENSION IA(200)                                               GRD00230
      LOGICAL OPT                                                     GRD00240
      DIMENSION KEYS(5)                                               GRD00250
C     INTEGER TIM1,TIM2,TIM3,TIM4                                     GRD00260
C     INTEGER Z                                                       GRD00270
C     Z=11                                                            GRD00280
      DATA KEYS/3HMAP,3HEND,3HIRR,3HDAT,3H999/                        GRD00290
      OPT(24)=.FALSE.                                                 GRD00300
      OPT(25)=.FALSE.                                                 GRD00310
      MAPN=0                                                          GRD00320
      IERR=0                                                          GRD00330
C   READ CONTROL WORD                                                 GRD00340
  100 IF(OPT(25)) IERR=IERR+1                                         GRD00350
      READ(5,1000) KEY                                                GRD00360
      OPT(25)=.FALSE.                                                 GRD00370
      DO 10 I=1,5                                                     GRD00380
      IF(KEY.EQ.KEYS(I)) GO TO 11                                     GRD00390
   10 CONTINUE                                                        GRD00400
C                                                                     GRD00410
C   ERROR MESSAGES                                                    GRD00420
      WRITE(6,2000) KEY                                               GRD00430
      WRITE(8,9000)                                                   GRD00440
      ENDFILE 8                                                       GRD00450
      REWIND 8                                                        GRD00460
      STOP                                                            GRD00470
  120 WRITE(6,1010)                                                   GRD00480
      WRITE(8,9000)                                                   GRD00490
      ENDFILE 8                                                       GRD00500
      REWIND 8                                                        GRD00510
      STOP                                                            GRD00520
   11 GO TO (1,2,3,4,5),I                                             GRD00530
    2 MAPN=MAPN-IERR                                                  GRD00540
      WRITE(6,4010) MAPN                                              GRD00550
```

```
      WRITE(Z,9000)
      END FILE Z
      REWIND Z
      STOP
    4 WRITE(6,2010)
      WRITE(8,9000)
      ENDFILE 8
      REWIND 8
      STOP
    5 GO TO100
C
C     READ IN IRREGULAR OUTLINE
    3 IP=0
      OPT(24)=.TRUE.
      REWIND 9
      WRITE(6,1050)
  106 READ(5,1030) IK,NCB,NCE
      IF (IK .NE.99999) GO TO 107
      OPT(24)=IP.GT.0
      GO TO 100
  107 IF(IK.LT.1) IK=1
      DO 105 I=1,IK
      IP=IP+1
      WRITE(6,1030) IP,NCB,NCE
  105 WRITE(9)  NCB,NCE
      GO TO  106
C
C     READ IN THE MAP CONTROLS
    1 MAPN=MAPN+1
C     CALL CTIME(TIM1)
      ND=0
      WRITE(6,1040)
      CALL MAPIN(MAPN)
      IF(OPT(25)) GO TO 100
C
C   READ THE DATA
  200 ND=ND+1
      IF(OPT(24) .AND. IP.NE.NCD) GO TO 120
      CALL INDATA(NCD,NCA,ND,IA)
      IF(OPT(25)) GO TO 100
C   LOOP THROUGH FLATON FOR EACH SHEET OF THE MAP
C
C     CALL CTIME(TIM2)
      ISH=0
  300 ISH=ISH+1
      WRITE (8,3000)
      WRITE(8,4000) MAPN,ISH,ND
      WRITE (8,3040)
      CALL FLATON(ISH,ND)
      WRITE (8,3040)
      IF (ISH.LT.NSHEET) GO TO 300
      IF(ND.LT.NUD) GO TO 200
C     CALL CTIME(TIM3)
C
C   WRITE THE DATA BELOW THE MAP
      WRITE (8,3050) TITLE
      IF(NTX.GT.0) WRITE(8,3080) (TEXT(I),I=1,NTX)
      IF(OPT(12) .AND. OPT(22)) GO TO 210
      CALL HHEAD
C     CALL CTIME(TIM4)
```

```
  210 IF(.NOT.OPT(15)) GO TO 100                                         GRD01160
C       T1=(TIM2-TIM1)/300.                                             GRD01170
C       T2=(TIM3-TIM2)/300.                                             GRD01180
C       T3=(TIM4-TIM1)/300.                                             GRD01190
C       T4=TIM4/300.                                                    GRD01200
C       WRITE(6,9050) T1,T2,T3,T4                                       GRD01210
        GO TO 100                                                       GRD01220
 1000 FORMAT(A3)                                                        GRD01230
 2000 FORMAT(2H -,A3,34H- IS AN INVALID INPUT CONTROL WORD)             GRD01240
 1010 FORMAT(//2X,52H IRREGULAR OUTLINES DO NOT SPECIFY THE CORRECT NUMBGRD01250
     1ER OF ROWS,)                                                      GRD01260
 4010 FORMAT(1H1,I5,11H  MAPS MADE/15H   RUN COMPLETE)                  GRD01270
 2010 FORMAT(//34H DATA IS NO LONGER A VALID CONTROL)                   GRD01280
 1050 FORMAT(1H1,8(/),1X,17HIRREGULAR OUTLINE,/1X,17H-----------------) GRD01290
 1030 FORMAT(3I5)                                                       GRD01300
 1040 FORMAT(1H1,8(/),1X, 12HMAP TITLE   ,/1X,12H---------   ,/)        GRD01310
 3000 FORMAT (1H1,8(/))                                                 GRD01320
 4000 FORMAT(1X,4HMAP ,I2,7H,SHEET ,I2,10H,DATA SET ,I2)                GRD01330
 3040 FORMAT (2H *,12(10H----------),10H---------*)                     GRD01340
 3060 FORMAT(////(1X,20A4/1X)//)                                        GRD01350
 3080 FORMAT (/(40X,20A4))                                              GRD01360
 9000 FORMAT(/////////////,' ',46X,'********** END OF DATA FILE ********GRD01370
     1*')                                                               GRD01380
C9050 FORMAT(//' TIME IN SECONDS - DATA INPUT    ',F8.3/17X,'- PRINTING MGRD01390
C    CAP ',F8.3/17X,'- TOTAL FOR MAP',F8.3/17X,'- TOTAL ELAPSED',F8.3)  GRD01400
      END                                                               GRD01410
```

```
IDENT MAPIN
      SUBROUTINE MAPIN(MAPN)
      COMMON/A/ NCD,NCA,NGD,NGA,NSHEET,NCS,NCF,NCL,NUMCH,NCST,NRST
      COMMON/B/ NLEVEL,IFORM,NOD,IHIST,NTX,OPT(25)
      COMMON/LIM/ VALMAX,VALMIN,RANGE(20),VAL(21),PRANGE(20),NFREQ(25)
      COMMON /SYMBLS/ SYMBOL(25,4),NS(10),TITLE(60),TEXT(800)
      LOGICAL OPT
      INTEGER SYMBOL
      DIMENSION A(6)
      DATA TXTEND/4HENDT/,PACEND/4H9999/
      IF(MAPN.GT.1) GO TO 200
      NTX=0
      NOD=0
      NGD=4
      NGA=5
      NLEVEL=10
      NUMCH=1
      IHIST =1
      DO 201 I=1,23
  201 OPT(I)=.FALSE.
  200 READ (5,1000) TITLE
      WRITE(6,1010) TITLE
      WRITE(6,1020)
  100 READ (5,1030) IOPT,(A(I),I=1,6)
      IF(IOPT.EQ.99999) GO TO 300
      GO TO (1,2,3,4,5,6,7,8,9,10,11,12,13,14,15 ),IOPT
        WRITE(6,9000) IOPT
      GO TO 100
  300 IF(.NOT.OPT(12) .AND. NLEVEL.GT.10) NLEVEL=10
      IF(OPT(1)) GO TO 301
      WRITE(6,9001)
      OPT(25)=.TRUE.
      RETURN
  301 IF(OPT(7)) RETURN
      WRITE(6,9002)
      OPT(25)=.TRUE.
      RETURN
C
C     OPTION 1  READ THE GRID CONTROLS
    1 OPT(1)=.TRUE.
      IF(OPT(12)) WRITE(6,9003)
      IF(OPT(13)) WRITE(6,9004)
      OPT(12)=.FALSE.
      OPT(13)=.FALSE.
      NCD=A(1)
      NCA=A(2)
      IF(A( 3 ).EQ.0.0) GO TO 109
      NGD=A(3)
      NGA=A(4)
      IF(NGA.EQ.1 .OR. NGD.EQ.1) OPT(8)=.TRUE.
  109 WRITE(6,2000)IOPT,NCD,NCA
      WRITE(6,2010)      NGD,NGA
C     SET PARAMETERS AND CALCULATE THE NUMBER OF SHEETS
  110 NCS=129/NGA
      NSHEET=(NCA/NCS)+1
      IF(MOD(NCA,NCS).EQ.0) NSHEET=NSHEET-1
      IF(NSHEET.EQ.1) GO TO 100
C     IF MORE THAN ONE PAGE - SET NUMBER OF  CELLS PER SHEET
  112 NCR=(NCS*NSHEET)-NCA
      NCRH=NCR/2
```

```
      NCF=NCS-NCRH
      NCL=NCS-NCR+NCRH
      GO TO 100
C
    2 OPT(2)=A(1).GT.0.0
      OPT(20)=A(1).LT.0.0
      IFORM=A(1)
      NOD=A(3)
      WRITE(6,3000 ) IOPT,IFORM
      IF(NOD.GT.1) WRITE(6,3020) NOD
      GO TO 100
C
C     OPTION 3 READ THE NUMBER OF LEVELS
    3 NLEVEL=A(1)
      WRITE(6,1040)IOPT,NLEVEL
      GO TO 100
C
C     OPTION 4 MINIMUM VALUE
    4 VALMIN=A(1)
      OPT(4)=A(2).EQ.0.0
      IF(OPT(4)) WRITE(6,1050) IOPT,VALMIN
      GO TO 100
C
C     OPTION 5 MAXIMUM VALUE
    5 VALMAX=A(1)
      OPT(5)=A(2).EQ.0.0
      IF(OPT(5)) WRITE(6,1060) IOPT,VALMAX
      GO TO 100
C
C     OPTION 6 VALUE SCALING
    6 OPT(6)=A(1).GT.0.0
      IF(.NOT.OPT(6)) GO TO 100
      DO 102 I=1,6
  102 RANGE(I)=A(I)
      IF(NLEVEL.GT.6) READ(5,1030) I8,(RANGE(I),I=7,NLEVEL)
      WRITE(6,1080)IOPT,(RANGE(I),I=1,NLEVEL)
      GO TO 100
C
C     OPTION 7 SYMBOLISM
    7 OPT(7) =.TRUE.
      READ(5,1090) SYMBOL
      WRITE(6,1100) IOPT,SYMBOL
      GO TO 100
C
C     OPTION 8 FLAG POINT SWITCH
    8 OPT(8)=A(1).EQ.1.0
      IF(OPT(8)) WRITE(6,1180) IOPT
C     OPTION 9 HISTOGRAM SWITCH
      GO TO 100
C
    9 OPT(21)=A(1).GT.0
      OPT(22)=A(2).GT.0
      IF(OPT(21)) WRITE(6,1230)
      IF(OPT(22)) WRITE(6,1240)
      GO TO 100
C
C     OPTION 10 TEXT
 1200 FORMAT(/I5,3X,11HMAP TEXT IS,/8X,11H-----------)
   10 WRITE(6,1200)IOPT
      NTX=0
```

```
      DO 106 N=1,40
      IBEG=NTX+1
      IEND=NTX+20
      READ (5,1000) (TEXT(I),I=IBEG,IEND)
      IF(TEXT(IBEG).EQ.TXTEND) GO TO 107
      NTX=IEND
  106 CONTINUE
      WRITE(6,1220)
  108 READ (5,1000) TXTND
      IF(TXTND.EQ.TXTEND) GO TO  107
      IF(TXTND.EQ.PACEND) GO TO 300
      GO TO 108
  107 WRITE (6,1210) (TEXT(I),I=1,NTX)
      GO TO 100
C
   11 DO 103 I=1,3
  103 OPT(8+I)=A(I).EQ.1.0
      IF(OPT(9))  WRITE(6,1140)
      IF(OPT(10)) WRITE(6,1150)
      IF(OPT(11)) WRITE(6,1160)
      GO TO 100
C
C     DOT MAP OPTION
   12 OPT(12)=A(1).EQ.1.0
      IF(.NOT.OPT(12)) GO TO 100
      WRITE(6,1110) IOPT
      NLEVEL=20
      IF(OPT(5)) NLEVEL=19
      IF(NGD.EQ.4 .AND. NGA.EQ.5) GO TO 100
      NGD=4
      NGA=5
      GO TO 150
C
C     GRID NUMBERING OPTION
   13 NUMCH=A(1)
      OPT(13)=A(1).GT.0.0
      IF(.NOT.OPT(13)) GO TO 100
      IF(NUMCH.GT.1) READ(5,4002)(NS(I),I=1,NUMCH)
      NCST=A(2)
      NRST=A(3)
      IF(NCST.EQ.0) NCST=1
      IF(NRST.EQ.0) NRST=NCD
      WRITE(6,4000)IOPT,NCST,NRST
      IF((NCA*NGA+20).GT.(NSHEET*(130-NGA))) GO TO 111
      GO TO 100
  111 NSHEET=NSHEET+1
      GO TO 112
C
C     PRESCALED DATA OPTION
   14 OPT(14)=A(1).EQ.1.0
      OPT(22)=.TRUE.
      IF(OPT(14))  WRITE(6,1190)
      GO TO 100
   15  OPT(15)=A(1).GT.0
      IF(OPT(15)) WRITE(6,1250)
      GO TO 100
 1000 FORMAT (20A4)
 1210 FORMAT(1X,20A4,/)
 1220 FORMAT(//1X,27HELECTIVES USED FOR THIS MAP./1X,27H---------------
     1------------,/)
```

```
1030  FORMAT(I5,5X,6F10.0)
1040  FORMAT(/I5,3X,I2,7H LEVELS)
1050  FORMAT(/I5,3X,33HTHE MINIMUM VALUE IS SPECIFIED AS,F10.2)
1060  FORMAT(/I5,3X,33HTHE MAXIMUM VALUE IS SPECIFIED AS,F10.2)
1080  FORMAT(/I5,3X,36HTHE RELATIVE SIZE OF EACH LEVEL IS -,/10F10.2/)
1090  FORMAT(25A1)
1100  FORMAT(/I5,3X,17HTHE SYMBOLS ARE -,4(/10X,25A1)/)
1110  FORMAT(/I5,3X,20HDOT MAP SYMBOLS USED)
1140  FORMAT(/3X,33H11    THE VALUES MAPPED ARE LISTED)
1150  FORMAT(/3X,42H11    THE VALUES MAPPED ARE STORED ON CARDS)
1160  FORMAT(/3X,42H11    THE LEVELS MAPPED ARE STORED ON CARDS)
1180  FORMAT(/I5,3X,27HNO FLAG POINTS IN GRID CELL)
1190  FORMAT(/3X,40H14    THE DATA IS ASSUMED TO BE PRESCALED)
1210  FORMAT(20X,20A4)
1220  FORMAT(///20X,22HTOO MANY LINES OF TEXT)
1230  FORMAT(/4X,'9    HISTOGRAM INCLUDED AFTER FREQUENCIES')
1240  FORMAT(/4X,'9    NUMERIC INFORMATION SUPPRESSED')
1250  FORMAT(/I5,'  TIME FOR EACH MAP PRINTED')
2000  FORMAT(/I5,3X,12HGRID SIZE IS,I4,15H CELLS DOWN AND,I4,13H CELLS A
     1CROSS)
2010  FORMAT(     8X,12HCELL SIZE IS,I4,20H CHARACTERS DOWN AND,I4,18H CH
     1ARACTERS ACROSS)
3000  FORMAT(/I5,3X,20HTHE FLEXIN LOCATOR =,I3)
3020  FORMAT(8X,19HTHE DATA IS READ IN,I3,5H SETS)
4000  FORMAT(/I5,3X,24HGRID NUMBERING BEGINS AT,2I6)
4002  FORMAT(10I1)
9000  FORMAT(/I5,3X,'******* INVALID ELECTIVE NUMBER *******')
9001  FORMAT(//37H ELECTIVE 1 NOT SPECIFIED - MAP STOPS)
9002  FORMAT(//37H ELECTIVE 7 NOT SPECIFIED - MAP STOPS)
9003  FORMAT(//51H ELECTIVE 12 IS CANCELED WHEN ELECTIVE 1 IS CHANGED)
9004  FORMAT(//51H ELECTIVE 13 IS CANCELED WHEN ELECTIVE 1 IS CHANGED)
      END
```

```
IDENT INDATA
      SUBROUTINE INDATA (NCD,NCA,ND,IA)
      COMMON/C/ P(10000)
      COMMON/B/ NLEVEL,IFORM,NOD,IHIST,NTX,OPT(25)
      COMMON/LIM/ VALMAX,VALMIN,RANGE(20),VAL(21),PRANGE(20),NFREQ(25)
      COMMON/STTS/ STAT(7)
      LOGICAL FIRST,OPT
      DIMENSION IA(IFORM)
C     INTEGER Z
C     Z=11
      IF(OPT(24)) REWIND 9
      NDATA=NCA*NCD
      FIRST=.TRUE.
C   READ IN THE DATA
C   NOTE OPT(24)=.TRUE. FOR IRREGULAR OUTLINES  AND OPT(2)=.TRUE. FOR
C   READING A LOGICAL FILE
      L=1
      M=NCA
      DO 100 I=1,NCD
      IC=NCA*(I-1)
      IF(.NOT.OPT(24)) GO TO 111
      READ(9)  MCB,MCE
      IF((MCE+MCB).GE.NCA) GO TO 170
      M=NCA-MCE
      L=MCB
      IF(L.EQ.0) GO TO 101
      DO 102 J=1,L
      ID=IC+J
  102 P(ID)=-999999.0
  101 L=L+1
  111 IF(.NOT.OPT(2)) GO TO 150
      DO 103 J=L,M
      ID=IC+J
      CALLFLEXIN(IFORM,P(ID),FIRST,ND)
  103 FIRST=.FALSE.
      GO TO 151
  152 CONTINUE
  150 CONTINUE
C 150 READ(14,END=152) (P(IC+J),J=L,M)
  151 IF(M.EQ.NCA) GO TO 100
      M=M+1
      DO 105 J=M,NCA
      ID=IC+J
  105 P(ID)=-999999.0
  100 CONTINUE
C     IF(OPT(2) .AND. ND.GT.NOD) REWIND 12
C
C     WRITE OR PUNCH THE UNSCALED DATA VALUES
      IF(OPT(9)) WRITE(6,1010)
      IF(OPT(9)) WRITE(6,1000) (N,P(N),N=1,NDATA)
      IF(OPT(10))WRITE(7,1000) (N,P(N),N=1,NDATA)
      IF(.NOT.OPT(14))GO TO 141
C
C    SET SCALED DATA
      DO 140 N=1,NDATA
      IF (P(N).EQ.-999999.0) P(N)=24.0
  140 P(N)=P(N)+1
      GO TO 200
C
C     FIND THE MAXIMUM OR MINIMUM OF DATA
```

```
  141 CONTINUE
      IF(ND.GT.1) GO TO901
      PN=0
      PHI=-999999.0
      PLO= 999999.0
      PX1=0
      PX2=0
      PX3=0
      PX4=0
  901 CONTINUE
      DO 204 N=1,NDATA
      IF(P(N).EQ.-999999.0) GO TO 204
      PN=PN+1
  205 PLO=AMIN1(PLO,P(N))
      PHI=AMAX1(PHI,P(N))
      PX1=PX1+P(N)
      PX2=PX2+P(N)**2
      PX3=PX3+P(N)**3
      PX4=PX4+P(N)**4
  204 CONTINUE
      IF(ND.GT.1) GO TO902
      IF(.NOT.OPT(4)) VALMIN=PLO
      IF(.NOT.OPT(5)) VALMAX=PHI
C
C     SET PARAMETERS TO SCALE THE DATA
  201 VAL(1)=VALMIN
      ARANGE=VALMAX-VALMIN
      IF(ARANGE.LT.0.0000001) GO TO 171
      IF(.NOT.OPT(6)) GO TO 118
      TRANGE=0.0
      DO 121 I=1,NLEVEL
  121 TRANGE=TRANGE+RANGE(I)
  118 VALINC= ARANGE/NLEVEL
      DO 122 I=1,NLEVEL
      IF(OPT(6)) VALINC=RANGE(I)*ARANGE/TRANGE
      PRANGE(I)=VALINC*100.0/ARANGE
  122 VAL(I+1)=VAL(I)+VALINC
      VAL(NLEVEL+1)=VALMAX
  902 CONTINUE
C
C     CALCULATE THE SCALED DATA VALUE
  199 DO 123 N=1,NDATA
      IF(P(N).EQ.-999999.0) GO TO 124
      IF(P(N).LT.VALMIN) GO TO 127
      DO 125 I=1,NLEVEL
      IF(P(N).LE.VAL(I+1))  GO TO 126
  125 CONTINUE
      P(N)=23.0
      GO TO 123
  124 P(N)=25.0
      GO TO 123
  126 P(N)=I
      GO TO 123
  127 P(N)=21.0
      IF(OPT(12)) P(N)=0.0
  123 CONTINUE
      IF(OPT(11))WRITE(7,1000) (N,P(N),N=1,NDATA)
C
C   CALCULATE FREQUENCIES
      IF(ND.GT.1) GO TO903
```

```
200 DO 129 I=1,25
    IF(I.LT.8)  STAT(I)=0
129 NFREQ(I)=0
903 CONTINUE
    IF(OPT(14)) GO TO 904
    STAT(1)=PN
    STAT(2)=PHI
    STAT(3)=PLO
    STAT(4)=PX1/PN
    STAT(5)=(SQRT(PN*PX2-PX1**2))/PN
    STAT(6)=0
    STAT(7)=0
904 CONTINUE
    DO 203 N=1,NDATA
    I=P(N)
203 NFREQ(I)=NFREQ(I)+1
    RETURN
171 WRITE(6,1030)
    OPT(25)=.TRUE.
    RETURN
170 WRITE(6,1020) I
    WRITE(8,9000)
    REWIND 8
    STOP
1000 FORMAT(I5,5XF10.2)
1010 FORMAT(1H1,8(/),1X,20HUNSCALED DATA VALUES,/1X,20H---------------
    1----)
1020 FORMAT(2X,39HERROR - TOO MANY CELLS REMOVED FROM ROW,I5)
1030 FORMAT('  DATA RANGE IS ZERO  -  MAP STOPS')
9000 FORMAT(//////////,' ',46X,'********** END OF MAP PRINT OUT *******
    1***')
    END
```

```
IDENT FLATON
      SUBROUTINE FLATON(ISH,ND)
      COMMON/C/ P(10000)
      COMMON/A/ NCD,NCA,NGD,NGA,NSHEET,NCS,NCF,NCL,NUMCH,NCST,NRST
      COMMON/B/ NLEVEL,IFORM,NOD,IHIST,NTX,OPT(25)
      COMMON /SYMBLS/ SYMBOL(25,4),NS(10),TITLE(60),TEXT(800)
      COMMON /OUTPUT/ MAPALL(129,4)
      DIMENSION X(10,129),INUM(129,4)
      INTEGER BLANK,SYMBOL,SYM
      LOGICAL OPT,FIN
      DIMENSION NUM(10),STCEL(4,5),IR(4)
C     INTEGER Z
C     Z=11
      DATA BLANK/1H /,PLUS/1H+/,SYMI/1HI/,SYM/1HC/
      DATA NUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/
      DATA STCEL/16.0,6.0,15.0,8.0,18.0,9.0,14.0,11.0,4.0,17.0,1.0,12.0,
     12.0,5.0,10.0,19.0,20.0,7.0,13.0,3.0/
C
C     SETS THE PARAMETERS FOR EACH SHEET OF THE MAP
      FIN=.FALSE.
      N=NCA
      MNCP=0
      IF(NSHEET.EQ.1) GO TO 500
      N=NCF
      IF(ISH.EQ.1) GO TO 500
      N=NCS
      MNCP=NCF+NCS*(ISH-2)
      IF(ISH.EQ.NSHEET) N=NCL
  500 JFIRST=64-(NGA*N)/2
      IX=(NGD/2)+1
      JZ=NGA/2+1
      KK=1
      NCH=3
      IF(NUMCH.GT.1) NCH=4
      XRST=NRST-NCD*(ND-1)
      BORDER=SYMI
      IF(.NOT.OPT(13)) GO TO 100
      KZ=MNCP-1
      DO 200 K=1,N
      KZ=KZ+1
      NUB=NCST+(KZ/NUMCH)
      INUM(K,1)=NUB/100
      INUM(K,2)=NUB/10-INUM(K,1)*10
      INUM(K,3)=NUB-INUM(K,1)*100-INUM(K,2)*10
      IN=MOD(KZ,NUMCH)
  200 INUM(K,4)=NS(IN+1)
  100 WRITE(8,1000)(BLANK,BORDER,(SYMBOL(25,1),J=1,129),BORDER,I=1,3)
      IF(.NOT.OPT(13)) GO TO 180
      DO 201 J=1,129
      DO 201 K=1,4
  201 MAPALL(J,K)=SYMBOL(25,1)
      WRITE(8,1002)
 1002 FORMAT(32X,'BCDEFGHIJKLMNOPQRSTUVWXYZABCDEFGHIJKLMNOPQRSTUVWXYZABC
     1DEFGHIJKLMNOPQ')
      WRITE(8,1003)
 1003 FORMAT(32X,'AAAAAAAAAAAAAAAAAAAAAAAAABBBBBBBBBBBBBBBBBBBBBBBBBCCC
     2CCCCCCCCCCCCCCC')
  180 WRITE(8,1000)(BLANK,BORDER,(SYMBOL(25,1),J=1,129),BORDER,I=1,3)
      IF(FIN) RETURN
      FIN=.TRUE.
```

```
C
  181 DO 124 IROW=1,NCD
C       BLANKS OUT A ROW TO BACK GROUND SYMBOLISM
      DO 101 I=1,NGD
      DO 101 J=1,129
      IF(I.GT.4) GO TO 101
      MAPALL(J,I)=SYMBOL(25,1)
  101 X(I,J)=25.0
C       INITIALISE THE LOOP FOR EACH ROW OF CELLS
      JB=JFIRST
      ID=(IROW-1)*NCA+MNCP
      DO 130 K=1,N
      ID = ID + 1
      IF(P(ID).EQ.25.0) GO TO 130
C       INSERTS SYMBOLISM KEY FOR A GRID CELL
      DO 132 I=1,NGD
      DO 132 JY=1,NGA
      J=JB+JY
      IF(OPT(12)) GO TO 131
      X(I,J) = P(ID)
      IF(OPT(8)) GO TO 132
      IF(I.NE.IX .OR. JY.NE.JZ) GO TO 132
      X(I,J)=X(I,J)+10
      IF(P(ID).GT.20.0) X(I,J)=X(I,J)-9
      GO TO 132
  131 MAPALL(J,I)=  BLANK
      IF(STCEL(I,JY).LE.P(ID)) MAPALL(J,I)=SYM
  132 CONTINUE
  130 JB=JB+NGA
C
C
      DO 124 M=1,NGD
      IF(OPT(12)) GO TO 191
C       CONVERTS A LINE TO SYMBOLISM
      DO 103 J=1,129
      JSYM=X(M,J)
      DO 103 K=1,4
  103 MAPALL(J,K)=SYMBOL(JSYM,K)
      GO TO190
  191 KK=M
  190 IF(.NOT.OPT(13)) GO TO 220
      IF(M.NE.IX) GO TO 220
      IF(ISH.GT.1 .AND. ISH.LT.NSHEET) GO TO 220
      NUB=XRST-(IROW-1)/NUMCH
      IR(1)=NUB/100
      IR(2)=NUB/10-IR(1)*10
      IR(3)=NUB-IR(1)*100-IR(2)*10
      IN=NUMCH-MOD((IROW-1),NUMCH)
      IR(4)=NS(IN)
      JX=JFIRST-8
      DO 223 J=1,2
      DO 224 I=1,NCH
      II=IR(I)+1
      MAPALL(JX,KK)=NUM(II)
  224 JX=JX+1
  223 JX=JFIRST+N*NGA+6
C       WRITES A LINE
  220 WRITE(8,1000) BLANK,BORDER,(MAPALL(J,KK),J=1,129),BORDER
      IF(OPT(12)) GO TO 124
C       WRITES OVERPRINT LINES
```

```
      DO 123 I=2,4                                                      GRD06210
      DO 120 J=1,129                                                    GRD06220
      IF (MAPALL(J,I) .NE. BLANK) GO TO 121                             GRD06230
  120 CONTINUE                                                          GRD06240
      GO TO 123                                                         GRD06250
  121 WRITE(8,1000) PLUS ,BLANK ,(MAPALL(J,I),J=1,129),BLANK            GRD06260
  123 CONTINUE                                                          GRD06270
  124 CONTINUE                                                          GRD06280
      GO TO 100                                                         GRD06290
 1000 FORMAT (132A1)                                                    GRD06300
 1001 FORMAT(2A1,129X,A1)                                               GRD06310
      END                                                               GRD06320
```

```
IDENT HHEAD                                                          GRD06329
      SUBROUTINE  HHEAD                                              GRD06330
      COMMON/B/ NLEVEL,IFORM,NOD,IHIST,NTX,OPT(25)                   GRD06340
      COMMON/LIM/ VALMAX,VALMIN,RANGE(20),VAL(21),PRANGE(20),NFREQ(25) GRD06350
      COMMON/STTS/ STAT(7)                                           GRD06360
      COMMON /SYMBLS/ SYMBOL(25,4),NS(10),TITLE(60),TEXT(800)        GRD06370
      COMMON /OUTPUT/ MAPALL(129,4)                                  GRD06380
      DIMENSION MAPL(84,4),JSYM(12,4),ASYM(12,4),FMT(5),MAPLA(129)   GRD06390
      EQUIVALENCE  (MAPL(1,1),MAPALL(1,1)),(JSYM(1,1),MAPALL(80,3))  GRD06400
      EQUIVALENCE  (MAPLA(1),MAPALL(1,1)),(ASYM(1,1),MAPALL(1,4))    GRD06410
      DIMENSION LOW(10),IGH(11)                                      GRD06420
      INTEGER BLANK,SYMI,SYMBOL,ASYM                                 GRD06430
      LOGICAL FIN,OPT                                                GRD06440
C     INTEGER Z                                                      GRD06450
C     Z=11                                                           GRD06460
      DATA FMT/'(2X,','2A4,','10X,','10F1','0.2)'/                   GRD06470
      DATA A/'MINI'/,B/'MAXI'/,C/'MUM '/,D/'    '/,E/'10X,'/         GRD06480
      DATA LOW/'L','O','W',' ','V','A','L','U','E','S'/              GRD06490
      DATA IGH/'H','I','G','H',' ','V','A','L','U','E','S'/          GRD06500
      DATA BLANK/1H /,SYMI/1HI/,EQS/1H=/                             GRD06510
      NWORK=NLEVEL+1                                                 GRD06520
      FMT(3)=D                                                       GRD06530
      IF(OPT(4)) FMT(3)=E                                            GRD06540
      DO 120 I=1,129                                                 GRD06550
  120 MAPLA(I)=BLANK                                                 GRD06560
      IF(OPT(22)) GO TO 130                                          GRD06570
      WRITE (8,1000) NLEVEL,VALMIN,VALMAX,STAT(4),STAT(5)            GRD06580
      IF(.NOT. OPT(12)) GO TO 500                                    GRD06590
      WRITE(8,2010)                                                  GRD06600
      WRITE(8,2030) (N,VAL(N),VAL(N+1),NFREQ(N),N=1,NLEVELQ          GRD06610
      RETURN                                                         GRD06620
  500 WRITE(8,1010)                                                  GRD06630
      WRITE(8,FMT) A,C,(VAL(I),I=1,NLEVEL)                           GRD06640
      WRITE(8,FMT) B,C,(VAL(I),I=2,NWORK)                            GRD06650
      WRITE (8,1020)                                                 GRD06660
      WRITE(8,FMT) D,D,(PRANGE(I),I=1,NLEVEL)                        GRD06670
      WRITE (8,1030)                                                 GRD06680
  130 J=0                                                            GRD06690
      IF(.NOT.OPT(4)) GO TO 200                                      GRD06700
      J=J+1                                                          GRD06710
      DO 201 K=1,4                                                   GRD06720
      JSYM(J,K)=SYMBOL(21,K)                                         GRD06730
  201 ASYM(J,K)=SYMBOL(22,K)                                         GRD06740
      DO 210 L=1,NLEVEL                                              GRD06750
      LL=NLEVEL+1-L                                                  GRD06760
  210 NFREQ(LL+1)=NFREQ(LL)                                          GRD06770
      NFREQ(1)=NFREQ(21)                                             GRD06780
      DO 211 I=1,10                                                  GRD06790
  211 MAPLA(I)=LOW(I)                                                GRD06800
  200 DO 202 JJ=1,NLEVEL                                             GRD06810
      J=J+1                                                          GRD06820
      DO 202 K=1,4                                                   GRD06830
      JSYM(J,K)=SYMBOL(JJ,K)                                         GRD06840
  202 ASYM(J,K)=SYMBOL(JJ+10,K)                                      GRD06850
      IF(.NOT.OPT(5)) GO TO 203                                      GRD06860
      J=J+1                                                          GRD06870
      DO 204 K=1,4                                                   GRD06880
      JSYM(J,K)=SYMBOL(23,K)                                         GRD06890
  204 ASYM(J,K)=SYMBOL(24,K)                                         GRD06900
      NFREQ(J)=NFREQ(23)                                             GRD06910
```

```
      JJ=(J-1)*10
      DO 212 I=1,11
  212 MAPLA(I+JJ)=IGH(I)
  203 LL=J
      J=J-1
      FIN=.FALSE.
      NWORK=LL*10+1
      WRITE(8,1100)(MAPLA(I),I=1,NWORK)
      WRITE(8,1110)(I,I=1,J)
  122 WRITE(8,1100) (EQS    ,I=1,NWORK)
      IF(FIN) GO TO 127
  123 DO 124 J=1,2
      WRITE (8,1120) ((JSYM(L,1),M=1,9),L=1,LL)
      DO 124 K=1,3
      KK=5-K
  124 WRITE (8,1130)  ((JSYM(L,KK),M=1,9),L=1,LL)
      IF(FIN) GO TO 122
      WRITE(8,1140)  ((JSYM(L,1 ),M=1,4),  ASYM(L,1 ), (JSYM(L,1 ),M=1,4
     C), L=1,LL)
      DO 126 K=1,3
      KK=5-K
  126 WRITE(8,1130)  ((JSYM(L,KK),M=1,4),  ASYM(L,KK), (JSYM(L,KK),M=1,4
     C), L=1,LL)
      FIN=.TRUE.
      GO TO 123
  127 WRITE (8,1160) (NFREQ(I),I=1,LL)
      IF(.NOT.OPT(21))RETURN
C     BLANK PRINT ARRAY
      DO 100 I=1,4
      DO 100 J=1,84
  100 MAPL  (J,I)=BLANK
C     INITIALIZE PRINT ARRAY
      J=1
      MFREQ=0
      DO 104 I=1,LL
      MAPL(J,1)   =SYMI
      MFREQ=MFREQ+NFREQ(I)
      J=J+1
      DO 103 K=1,4
      DO 101 L=1,2
      MAPL(J,K)=JSYM(I,K)
  101 J=J+1
      MAPL(J,K)=ASYM(I,K)
      J=J+1
      DO 102 L=1,2
      MAPL(J,K)=JSYM(I,K)
  102 J=J+1
  103 J=J-5
      J=J+5
      MAPL   (J,1)=SYMI
  104 J=J+1
      MXFREQ=0
      DO 105 I=1,LL
      BIGNBR = NFREQ(I)*100
      BIGNO1 = MFREQ
      BIGNBR = (BIGNBR/BIGNO1)+1
      IF(NFREQ(I).GT.0) NFREQ(I)=BIGNBR
  105 MXFREQ=MAX0(NFREQ(I),MXFREQ)
      MXFREQ=MXFREQ-1
      KWORK=7*LL
```

```
      DO 110 I=1,MXFREQ                                                 GRD07490
C                                                                       GRD07500
C     BLANK USED BARS                                                   GRD07510
      DO 107 J=1,LL                                                     GRD07520
      IF (NFREQ(J) .NE. I-1) GO TO 107                                  GRD07530
      KSTART=7*J-6                                                      GRD07540
      KSTOP=7*J                                                         GRD07550
      DO 106 K=KSTART,KSTOP                                             GRD07560
      DO 106 L=1,4                                                      GRD07570
  106 MAPL  (K,L)=BLANK                                                 GRD07580
  107 CONTINUE                                                          GRD07590
C                                                                       GRD07600
C     WRITE LINE                                                        GRD07610
      WRITE (8,1220) I,(MAPL  (K,1),K=1,KWORK)                          GRD07620
C                                                                       GRD07630
C     WRITE OVERPRINT LINES                                             GRD07640
      DO 109 J=2,4                                                      GRD07650
      DO 108 K=1,KWORK                                                  GRD07660
      IF (MAPL  (K,J) .NE. BLANK) GO TO 109                             GRD07670
  108 CONTINUE                                                          GRD07680
      GO TO 110                                                         GRD07690
  109 WRITE (8,1200) (MAPL  (K,J),K=1,KWORK)                            GRD07700
  110 CONTINUE                                                          GRD07710
      WRITE(8,1230) NFREQ(25)                                           GRD07720
      RETURN                                                            GRD07730
 1000 FORMAT(///' DATA MAPPED IN',I3,' LEVELS BETWEEN EXTREME VALUES OF'GRD07740
     C,F10.2,' AND',F10.2,'  MEAN =',F10.2,' ST. DEV. =',F10.2)         GRD07750
 1010 FORMAT (///44H ABSOLUTE VALUE RANGE APPLYING TO EACH LEVEL)       GRD07760
 1020 FORMAT (///64H PERCENTAGE OF TOTAL ABSOLUTE VALUE RANGE APPLYING TGRD07770
     1O EACH LEVEL)                                                     GRD07780
 1030 FORMAT (///58H FREQUENCY DISTRIBUTION OF DATA POINT VALUES IN EACHGRD07790
     1 LEVEL)                                                           GRD07800
 1100 FORMAT(11X,121A1)                                                 GRD07810
 1110 FORMAT('  LEVELS',9X,'0',11(8X,I2))                               GRD07820
 1120 FORMAT (11X,12(1X,9A1))                                           GRD07830
 1130 FORMAT (1H+,10X,12(1X,9A1))                                       GRD07840
 1140 FORMAT('   SYMBOLS   ', 12(1X,9A1))                               GRD07850
 1160 FORMAT('   FREQUENCY',I7,11I10)                                   GRD07860
 1200 FORMAT (1H+, 9X,12(3X,7A1))                                       GRD07870
 1220 FORMAT ( 4X,I6,12(3X,7A1))                                        GRD07880
 1230 FORMAT(10X,'HISTOGRAM EXPRESSED AS PERCENT OF ALL NON-BACKGROUND CGRD07890
     CELLS'/10X,'NUMBER OF BACKGROUND CELLS =',I5)                      GRD07900
 2010 FORMAT (6H LEVEL,9X,7HMINIMUM,8X,7HMAXIMUM,8X,9HFREQUENCY,/)      GRD07910
 2030 FORMAT(I5,7XF10.2,5XF10.2,9XI5)                                   GRD07920
      END                                                               GRD07930
```

```
IDENT FLEXIN                                                          GRD07939
      SUBROUTINE FLEXIN(IFORM,T,FIRST)                                GRD07940
      DIMENSION SOIL(22)                                              GRD07950
      DATA SOIL/4.,5.,6.,25.,28.,59.,60.,63.,64.,76.,113.,114.,133.,134.GRD07960
     1,138.,168.,170.,206.,207.,208.,217.,71./                        GRD07970
      NTYPE=22                                                        GRD07980
      READ(11,11) S,V                                                 GRD07990
   11 FORMAT(3X,F3.0,30X,F2.0)                                        GRD08000
      T=10.                                                           GRD08010
      DO 300 J=1,NTYPE                                                GRD08020
      IF(S.EQ.SOIL(J)) GO TO 450                                      GRD08030
  300 CONTINUE                                                        GRD08040
      IF(V.EQ.12.) T=1.                                               GRD08050
      IF(V.EQ.8.) T=2.                                                GRD08060
      IF(V.EQ.11.) T=3.                                               GRD08070
      IF(V.EQ.3.) T=4.                                                GRD08080
      IF(V.EQ.31.) T=4.                                               GRD08090
      GO TO 500                                                       GRD08100
  450 IF(V.NE.12.) T=5.                                               GRD08110
      IF(V.NE.8.) T=5.                                                GRD08120
      IF(V.NE.11.) T=5.                                               GRD08130
      IF(V.NE.3.) T=5.                                                GRD08140
      IF(V.NE.31.) T=5.                                               GRD08150
      IF(V.EQ.12.) T=6.                                               GRD08160
      IF(V.EQ.8.) T=7.                                                GRD08170
      IF(V.EQ.11.) T=8.                                               GRD08180
      IF(V.EQ.3.) T=9.                                                GRD08190
      IF(V.EQ.31.) T=9.                                               GRD08200
  500 CONTINUE                                                        GRD08210
      RETURN                                                          GRD08220
      END                                                             GRD08230
```

APPENDIX B

VANDENBERG IRREGULAR OUTLINE

FOR GRID

Vandenberg Irregular Outline for GRID

Column

```
         11111111
12345678901234567
IRREGULAR OUTLINE
    1    7   59
    1    7   57
    1    7   52
    1    7   49
    1    7   48
    1    8   46
    2    8   45
    1    8   44
    2    8   43
    1    9   42
    1   10   41
    1   12   41
    1   13   40
    1   15   40
    1   15   39
    1   16   38
    1   17   38
    2   17   37
    2   17   36
    2   17   35
    1   16   34
    3   16   25
    1   16    9
    4   15    9
    2   14    9
    1   14    1
    4   13    1
    2   12    1
    1   12    0
    3   11    0
    2   10    0
    2    9    0
    1    8    4
    4    8    5
    2    9    5
    3   10    5
    1   11   11
    1   11   12
    1   13   12
    1   14   12
    1   14   13
```

AD-A040 462  SAN DIEGO STATE UNIV  CALIF CENTER FOR REGIONAL ENVIR--ETC  F/G 6/6
ECOLOGICAL ASSESSMENT OF VANDENBERG AIR FORCE BASE, CALIFORNIA.--ETC(U)
SEP 76  R M REILLY, F P STUTZ, C F COOPER  F29601-75-C-0116
UNCLASSIFIED  AFCEC-TR-76-15-VOL-3  NL

2 OF 2
AD A040462

END
DATE FILMED
7-77

Column

```
         11111111
12345678901234567

    1  15  13
    1  15  12
    2  16  12
    1  16  13
    1  17  13
    1  17  14
    1  18  14
    2  18  15
    2  18  17
    1  17  18
    2  17  19
    1  17  24
    3  16  24
    1  15  34
    2  15  35
    1  14  35
    1  14  34
    1  14  33
    1  13  32
    2  13  30
    1  12  31
    1  12  32
    1  11  33
    1  11  34
    1  11  32
    1  10  30
    1  10  28
    2   9  28
    3   8  26
    2   7  26
    2   6  26
    4   5  26
    1   5  27
    1   5  28
    1   4  29
    1   4  32
    2   4  34
    1   2  33
    1   4  32
    1   5  30
    1   5  23
    1   5  21
    1   5  20
    1   6  16
    1   8  16
```

Column

```
         11111111
12345678901234567

    1    9   16
    1   10   16
    1   25   16
    1   27   16
    1   28   17
    1   29   17
    1   31   17
    1   34   17
    1   36   17
    1   38   17
    2   40   17
    1   42   17
    1   43   17
    1   44   17
    1   44   18
    2   45   18
99999
```

APPENDIX C

SUBROUTINE FLEXIN FOR GRID OUTPUT DISPLAYING

SOILS WITH HIGH EROSION POTENTIAL

```
      SUBROUTINE FLEXIN(IFORM,T,FIRST)
      REAL SOIL(183),LEVEL(183)
      DATA SOIL/2.,3.,4.,16.,18.,23.,24.,25.,27.,28.,29.,30.,31.,32.,33.
     1,34.,35.,37.,38.,43.,55.,56.,57.,58.,59.,60.,62.,66.,67.,71.,74.,7
     25.,76.,78.,79.,80.,81.,91.,101.,107.,109.,112.,113.,114.,115.,118.
     3,119.,123.,126.,127.,129.,131.,132.,133.,134.,136.,137.,138.,161.,
     4162.,166.,167.,168.,175.,176.,185.,196.,205.,206.,211.,212.,213.,2
     514.,215.,216.,217.,226.,228.,231.,232.,233.,234.,235.,236.,237.,23
     68.,242.,243.,244.,245.,246.,247.,248.,249.,250.,254.,258.,259.,260
     7.,261.,263.,270.,272.,273.,275.,277.,278.,281.,282.,283.,284.,286.
     8,287.,288.,290.,291.,292.,218.,227.,5.,44.,46.,48.,52.,63.,64.,68.
     9,89.,92.,93.,102.,103.,106.,108.,110.,130.,170.,172.,177.,179.,186
    11.,187.,190.,219.,220.,229.,230.,239.,240.,241.,251.,252.,253.,255.
    12,256.,264.,265.,267.,271.,274.,276.,279.,280.,285.,289.,6.,65.,169
    13.,188.,94.,99.,116.,159.,160.,184.,204.,207.,208.,257.,173.,174.,4
    149.,0./
      DATA LEVEL/117*1.,2*2.,46*3.,4*4.,14*5./
      NTYPE=183
      READ(9,10) T
   10 FORMAT(3X,F3.0)
      DO 300 J=1,NTYPE
      IF(T.EQ.SOIL(J)) GO TO 450
  300 CONTINUE
      T=0
      GO TO 460
  450 T=LEVEL(J)
  460 CONTINUE
      RETURN
      END
```

# APPENDIX D

## SUBROUTINE FLEXIN FOR GRID PROGRAM DISPLAYING AREAS OF HIGH EROSION POTENTIAL BASED ON SOILS AND VEGETATION

```
      SUBROUTINE FLEXIN(IFORM,T,FIRST)
      FEAL  SCIL(183),LEVEL(183)
      DATA  SOIL/2.,3.,4.,16.,18.,23.,24.,25.,27.,28.,29.,30.,31.,32.,33.
     1,34.,35.,37.,36.,43.,55.,56.,57.,58.,59.,60.,62.,66.,67.,71.,74.,7
     25.,76.,78.,79.,80.,81.,91.,101.,107.,109.,112.,113.,114.,115.,118.
     3,119.,123.,126.,127.,129.,131.,132.,133.,134.,136.,137.,138.,161.,
     4162.,166.,167.,168.,175.,176.,185.,196.,205.,206.,211.,212.,213.,2
     514.,215.,216.,217.,226.,228.,231.,232.,233.,234.,235.,236.,237.,23
     68.,242.,243.,244.,245.,246.,247.,248.,249.,250.,254.,258.,259.,260
     7.,261.,263.,270.,272.,273.,275.,277.,278.,281.,282.,283.,284.,286.
     8,287.,288.,290.,291.,292.,218.,227.,5.,44.,46.,48.,52.,63.,64.,68.
     9,89.,92.,93.,102.,103.,106.,108.,110.,130.,170.,172.,177.,179.,186
    11.,187.,190.,219.,220.,229.,230.,239.,240.,241.,251.,252.,253.,255.
    12,256.,264.,265.,267.,271.,274.,276.,279.,280.,285.,289.,6.,65.,169
    13.,188.,94.,99.,116.,159.,160.,184.,204.,207.,208.,257.,173.,174.,4
    149.,C./
      DATA LEVEL/117*1.,2*2.,46*3.,4*4.,14*5./
      NTYPE=183
      READ(5,11) S,V
   11 FORMAT(3X,F3.0,30X,F2.0)
      T=S
      DO 300 J=1,NTYPE
      IF(T.EQ.SOIL(J)) GO TO 450
  300 CONTINUE
      T=0
      GO TO 460
  450 T=LEVEL(J)
  460 CONTINUE
      IF(V.EQ.16.) GO TO 461
      IF(V.NE.16.) GO TO 470
  461 IF(T.EQ.1.) T=6.
      IF(T.EQ.2.) T=7.
      IF(T.EQ.3.) T=8.
      IF(T.EQ.4.) T=9.
      IF(T.EQ.5) T=10.
  470 CONTINUE
      RETURN
      END
```

# APPENDIX E

## SUBROUTINE FLEXIN FOR GRID MAP DISPLAYING AREAS OF PRIME ECOLOGICAL SIGNIFICANCE ON VANDENBERG AFB

```
      SUBROUTINE FLEXIN(IFORM,T,FIRST)
      REAL A(9),B(9)
      DO 100 I= 1,9
100   B(I)=0.
      READ(9,11) (A(I),I=1,9)
 11   FORMAT(18X,9(2X,F2.0),26X)
      DO 200 IN=1,9
      DO 300 I=IN,9
300   IF(A(IN).EQ.A(I))   B(IN)=B(IN)+1
200   CONTINUE
      T=A(1)
      DO 400 I=1,8
400   IF(B(I).LT.B(I+1) ) T=A(I+1)
402   IF(T.EQ.2.) GO TO 600
403   IF(T.EQ.1.) GO TO 600
404   IF(T.EQ.72.) T=1.
405   IF(T.EQ.1.) GO TO 600
406   IF(T.EQ.8.) GO TO 590
      T=4.
      DO 451 J=1,9
451   IF(A(J).EQ.1.) T=5.
      IF(T.EQ.5.) GO TO 600
      DO 452 J=1,9
452   IF(A(J).EQ.72.) T=5.
      IF(T.EQ.5.) GO TO 600
      DO 453 J=1,9
453   IF(A(J).EQ.2.) T=6.
      IF(T.EQ.6.) GO TO 600
      DO 454 J=1,9
454   IF(A(J).EQ.8.) T=7.
      IF(T.EQ.7.) GO TO 600
      IF(T.EQ.4.) GO TO 600
590   T=3.
600   CONTINUE
      RETURN
      END
```

APPENDIX F

SUBROUTINE FLEXIN FOR GRID MAP DISPLAYING

AREAS OF SUITABLE HABITAT FOR THE

CALIFORNIA LEGLESS LIZARD ON VANDENBERG AFB

```
      SUBROUTINE FLEXIN(IFORM,T,FIRST)
      REAL SOIL(22)
      DATA SOIL/4.,5.,6.,25.,28.,59.,60.,63.,64.,76.,113.,114.,133.,134.
     1,138.,168.,170.,206.,207.,208.,217.,71./
      NTYPE=22
      READ(9,11) S,V
   11 FORMAT(3X,F3.0,30X,F2.0)
      T=10.
      DO 300 J=1,NTYPE
      IF(S.EQ.SOIL(J)) GO TO 450
  300 CONTINUE
      IF(V.EQ.12.) T=1.
      IF(V.EQ.8.) T=2.
      IF(V.EQ.11.) T=3.
      IF(V.EQ.3.) T=4.
      IF(V.EQ.31.) T=4.
      GO TO 500
  450 IF(V.NE.12.) T=5.
      IF(V.NE.8.) T=5.
      IF(V.NE.11.) T=5.
      IF(V.NE.3.) T=5.
      IF(V.NE.31.) T=5.
      IF(V.EQ.12.) T=6.
      IF(V.EQ.8.) T=7.
      IF(V.EQ.11.) T=8.
      IF(V.EQ.3.) T=9.
      IF(V.EQ.31.) T=9.
  500 CONTINUE
      RETURN
      END
```

APPENDIX G

SEARCH/COUNT PROGRAM AS ADAPTED TO THE BURROUGHS 3500 COMPUTER

```
?COMPILE SNFT10 XFORTN LIB DATA CARDS

?LST1
IDENT MAIN
FILE  11=ANFTOT,UNIT=TAPE,RECORD=80,BLOCKING=1,UNLABELED,FIXED
C        FREQUENCY COUNTING PROGRAM
C   OLD RUNWAY AND NEW CONSTRUCTION SURROUNDING IT  (43 CELLS )
      REAL*8 C(43),CX
      INTEGER S,EX,EL,D,ID
      INTEGER V(9)
      INTEGER VALUES(100),VALUEX(100),VALUEL(100),VALUEV(50)
      REAL FREQS(100),FREQX(100),FREQL(100),FREQV(50)
      REAL ACS(100),ACX(100),ACEL(100),ACV(100)
      DATA C/'AB086','BB086','CB086','ZA085','AB085','BB085','CB085','DB
     1085','XA084','YA084','ZA084','AB084','BB084','CB084','DB084','YA08
     23','ZA083','AB083','BB083','CB083','DB083','EB083','ZA082','AB082'
     3,'BB082','CB082','DB082','EB082','AB081','BB081','CB081','DB081','
     4EB081','BB080','CB080','DB080','EB080','CB079','DB079','EB079','FB
     5079','DB078','EB078'/
      NN=43
      JFREQS=0
      JFREQX=0
      JFREQL=0
      JFREQV=0
      DO 20 K=1,NN
   20 VALUES(K)=0
      DO 30 K=1,NN
   30 VALUEX(K)=0
      DO 40 K=1,NN
   40 VALUEL(K)=0
      DO 50 K=1,NN
   50 VALUEV(K)=0
      DO 60 K=1,NN
   60 FREQS(K)=0
      DO 70 K=1,NN
   70 FREQX(K)=0
      DO 80 K=1,NN
   80 FREQL(K)=0
      DO 90 K=1,NN
   90 FREQV(K)=0
      DO 270 K=1,NN
  270 ACS(K)=0.0
```

```
      DO 271 K=1,NN
  271 ACX(K)=0.0
      DO 272 K=1,NN
  272 ACEL(K)=0.0
      DO 273 K=1,NN
  273 ACV(K)=0.0
    8 READ(11,11)          S,EX,EL,(V(I),I=1,9),D,CX,ID
   11 FORMAT(3X,I3,4X,I2,4X,I1,1X,9(2X,I2),11X,I4,1X,A5,1X,I4)
      DO 300 J=1,NN
      IF(CX.EQ.C(J)) GO TO 450
  300 CONTINUE
      IF(ID.LT.4646) GO TO 8
      GO TO 3005
  450 WRITE(6,12) S,EX,EL,(V(I),I=1,9),D,CX,ID
   12 FORMAT('0','S=',I3,1X,'EX=',I2,1X,'EL=',I1,1X,'V=',9(I2,2X),9X,I4,
     11X,A5,1X,I4)
      IF(JFREQS.EQ.0) GO TO 110
      DO 100 J=1,JFREQS
      IF(S.NE.VALUES(J)) GO TO 100
      FREQS(J)=FREQS(J)+1
      GO TO 200
  100 CONTINUE
  110 JFREQS=JFREQS+1
      VALUES(JFREQS)=S
      FREQS(JFREQS)=1
  200 CONTINUE
      IF(JFREQX.EQ.0) GO TO 610
      DO 600 J=1,JFREQX
      IF(EX.NE.VALUEX(J)) GO TO 600
      FREQX(J)=FREQX(J)+1
      GO TO 800
  600 CONTINUE
  610 JFREQX=JFREQX+1
      VALUEX(JFREQX)=EX
      FREQX(JFREQX)=1
  800 CONTINUE
      IF(JFREQL.EQ.0) GO TO 1050
      DO 1000 J=1,JFREQL
      IF(EL.NE.VALUEL(J)) GO TO 1000
      FREQL(J)=FREQL(J)+1
      GO TO 1200
 1000 CONTINUE
```

```
1050 JFREQL=JFREQL+1
     VALUEL(JFREQL)=EL
     FREQL(JFREQL)=1
1200 CONTINUE
     DO 3000 K=1,9
     IF(JFREQV.EQ.0) GO TO 2050
     DO 2000 J=1,JFREQV
     IF(V(K).NE.VALUEV(J)) GO TO 2000
     FREQV(J)=FREQV(J)+1
     GO TO 2200
2000 CONTINUE
2050 JFREQV=JFREQV+1
     VALUEV(JFREQV)=V(K)
     FREQV(JFREQV)=1
2200 CONTINUE
3000 CONTINUE
     IF(ID.LT.4646) GO TO 8
3005 CONTINUE
     DO 250 L=1,NN
 250 ACS(L)=FREQS(L)*22.957
     DO 251 L=1,NN
 251 ACX(L)=FREQX(L)*22.957
     DO 252 L=1,NN
 252 ACEL(L)=FREQL(L)*22.957
     DO 253 L=1,NN
 253 ACV(L)=FREQV(L)*2.55
     WRITE(6,3010)
3010 FORMAT(///1X,'SOIL TYPE    FREQ.    EST. ACRES')
     WRITE(6,3015) (VALUES(N),FREQS(N),ACS(N), N=1,NN)
3015 FORMAT(3X,I3,7X,F4.0,5X,F5.0)
     WRITE(6,3020)
3020 FORMAT(///1X,'EXPOSURE    FREQ.    EST. ACRES')
     WRITE(6,3025) (VALUEX(N),FREQX(N),ACX(N), N=1,NN)
3025 FORMAT(3X,I2,8X,F4.0,5X,F5.0)
     WRITE (6,3030)
3030 FORMAT(///1X,'ELEVATION   FREQ.    EST. ACRES')
     WRITE(6,3035) (VALUEL(N),FREQL(N),ACEL(N), N=1,NN)
3035 FORMAT(3X,I1,9X,F4.0,5X,F5.0)
     WRITE(6,3040)
3040 FORMAT(///1X,'VEGETATION  FREQ.(SUBCELLS)  EST. ACRES')
     WRITE(6,3045) (VALUEV(N),FREQV(N),ACV(N), N=1,NN)
3045 FORMAT(3X,I2,10X,F5.0,11X,F5.0)
     STOP
     END
```

END

## APPENDIX H

### SMALL CELL COUNT PROGRAM LISTING AS ADAPTED TO THE BURROUGHS 3500 COMPUTER

```
1
2COMPILE SNFT10 XFORTN LIB DATA CARDS
3
11
3LST1
8

IDENT MAIN
FILE  11=ANFTOT,UNIT=TAPE,RECORD=80,BLOCKING=1,UNLABELED,FIXED
C  SMALL CELL COUNT PROGRAM
      INTEGER V(9), VALUEV(35), FREQV(35)
      JFREQV=0
    8 READ(11,11) (V(I),I=1,9), ID
   11 FORMAT(18X,9(2X,I2),22X,I4)
      DO 3000 K=1,9
      IF(JFREQV.EQ.0) GO TO 2050
      DO 2000 J=1,JFREQV
      IF(V(K).NE.VALUEV(J)) GO TO 2000
      FREQV(J)=FREQV(J) + 1
      GO TO 2200
 2000 CONTINUE
 2050 JFREQV = JFREQV + 1
      VALUEV(JFREQV) = V(K)
      FREQV(JFREQV) = 1
 2200 CONTINUE
 3000 CONTINUE
      IF(ID.LT.4646) GO TO 8
      WRITE(6,300)
  300 FORMAT(//1X,'VEGETATION  FREQ.')
      WRITE(6,400) (VALUEV(N),FREQV(N), N=1,35)
  400 FORMAT(5X,I2,7X,I4)
      STOP
      END

1
2END
3
```

## REFERENCES


1. Coulombe, H.N. and Cooper, C.F., Ecological Assessment of Vandenberg Air Force Base, California, AFCEC-TR-76-15, Vol. I, Center for Regional Environmental Studies, San Diego State University, San Diego, CA, 1976.

2. Coulombe, H.N. and Mahrdt, C.R., Ecological Assessment of Vandenberg Air Force Base, California, AFCEC-TR-76-15, Vol. II, Center for Regional Environmental Studies, San Diego State University, San Diego, CA, 1976.

3. The Coastal Plain of San Diego County, Laboratory for Experimental Design at California State Polytechnic University, Pomona, CA, 1972.

4. Abbreviated Master Plan, Vandenberg Air Force Base, Lompoc, California, Vol. I, Dept. of the Air Force, Directorate of Civil Engineering, 1970.

5. Miller, C.M., "Ecologic Relations and Adaptations of the Limbless Lizards of the Genus Anniella", Ecological Monographs 14(3), pp. 271-289, 1944.

6. DOD STS Facility Development Specification for VAFB V17 Landing and V18 Mate/Demate Station Sets, MDC E1391, McDonnel Douglas Astronautics Company-East, Torrance, CA, 1976.

7. Zar, J.H., Biostatistical Analysis, Prentice-Hall, Inc., NJ, 1974.

8. Sinton, D. and Steinitz, C., GRID Manual, Version 3, Laboratory for Computer Graphics and Spatial Analysis, Harvard University, Cambridge, MASS, 1971.

9. Soil Survey of Northern Santa Barbara Area, California, U.S. Department of Agriculture, Soil Conservation Service, Washington D.C., 1972.

10. Soil Survey, Santa Barbara Area, California, U.S. Department of Agriculture, Soil Conservation Service, Washington D.C., 1958.

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